ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

Vol. LVI, No. 15. CHICAGO, SATURDAY, APRIL 9, 1910. ISSUED WEEKLY.

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY
CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

Editors:
CHARLES W. PRICE. A. A. GRAY. F. H. BERNHARD.
Associate Editors:
H. FARRINGTON. H. EHRLICH. C. H. SEAVER.

SUBSCRIPTIONS.

One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each . .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
The Southern Convention of The American Institute of Electrical Engineers 721
Electrical Units 722
Electricity from Waste Heat 722
The Market for Hydroelectric Power in the South 723
Commercial Day, National Electric Light Association Convention 724
Commission News from New York 724
Belvedere Brooks 725
Railway Situation in Toledo 726
American Telephone Stock Increases 726
Interborough Railway Plans 726
Southern Convention of the American Institute of Electrical Engineers 727
Society for the Promotion of Engineering Education 731
The Electrical Equipment of a Manchester Hill 732
Minnesota Electrical Association 735
Commissioner Moore on the Patents Situation 740
Electrical Notes from Great Britain 742
The Northern Indiana and the Southern Michigan Deal 743
Traction Experiments in Switzerland 743
Joint Meeting of the Western Society of Engineers and the Chicago Section, A. I. E. E. 743
First Annual Meeting of the New England Section of the N. E. L. A. 744
An International Co-operative Investigation on Electrical Standards .. 746
Steam Railway Electrification 747
CENTRAL STATION PRACTICE:
Electrical Equipment for Coal Mines 748
The 220-Volt Problem 749
Boiler Explosions 750
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
Electric Car Lighting—II 751
Modern House Lighting with Low Voltage 752
Comparative Tests of the Light Variation of Different Arc Lamps 752
The Resistance and Reactance of Armored Cables 754
Hydroelectric Power Development in Russia 754
INDUSTRIAL POWER:
An Electro-Hydraulic Pumping Plant 755
A Long Trolley Trip 756
Brush Discharge Losses 757
A Wind Operated Electric Plant 757
TELEPHONY, TELEGRAPHY AND WIRELESS:
The Telephone and Train Dispatching 758
Regulation of Wireless Telegraph 759
Wireless Legislation 760
New Telephone Exchange for Chicago 760
ELECTRICAL ADVERTISING AND SELLING:
Making the Most of Electricity as an Advertising Medium 761
A Good Example 763
Electric Sign Business in Toronto 763
Bulletin of the Philadelphia Electric Company 763
Increasing the Lighting Load 763
Advertising Copy for Central Stations 763
INDUSTRIAL SECTION:
School Telephone Systems in Birmingham, Ala 764
Electrically Driven Boiler-Feed Pump 765
The Wisdom and Value of Duplicate Batteries 765
A Noiseless High-Speed Chain Drive 766
New York City Railway Decision 766
CURRENT ELECTRICAL NEWS 767
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 773
RECORD OF ELECTRICAL PATENTS 774

Copyright, 1910, by the Electrical Review Publishing Company.

THE SOUTHERN CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

On the occasion of the annual convention of the American Institute of Electrical Engineers at Frontenac, N. Y., last summer, President Lewis B. Stillwell called attention to the necessity of providing a more deliberate and comprehensive recognition of the territorial divisions of the Institute lying outside of the general headquarters at New York. This was largely inspired, we believe, by the evidences of loyal support upon the part of the representatives of the gographical sections in attendance at an informal and delightful meeting held during the closing hours of the convention. Since that time the officers of the Institute have been at work upon arrangements which might carry out to some extent Mr. Stillwell's suggestions, and the first tangible evidence of these plans was received with edifying success last week when the Southern Convention was held at Charlotte, N. C., under the auspices of the local section.

The papers dealt almost exclusively with conditions appertaining to the locality in which the meetings were held, and the dicta laid down in the excellent papers presented were supplemented by direct observation of the phenomena and engineering equipment under discussion.

Over five hundred enthusiastic members of the Institute attended the southern convention, and due to the limited number of papers and the thoroughgoing discussion, the convention, it is expected, will excite the unqualified endorsement of everyone present. In addition to this the entertainment features were delightful and the people of Charlotte gave unstintedly of their hospitality to make the affair a credit to the community.

In this respect it is but just that the felicitations of the Institute should be extended to Mr. W. S. Lee, chief engineer of the Southern Power Company, for the excellence of the arrangements for which he was responsible, and the unflagging zeal with which he made provisions for the comfort and entertainment of the visitors.

A similar convention will be held at San Francisco, California, on May 5, 6 and 7, when papers will be presented upon subjects appertaining to the generation and transmission of electricity in the coast country. It is hoped that there will be the same enthusiastic attendance and likewise a happy consummation of the Institute's efforts in this direction.

ELECTRICAL UNITS.

The investigation which is just being started at the Bureau of Standards, Washington, D. C., by representatives of the International Committee on Electrical Units and Standards, is of interest and importance to every electrical engineer. The London Conference of 1908 adopted a definite value for the electrochemical equivalent of silver. But until it is specified how the silver voltameter shall be used in applying this constant, the value of the international ampere and hence of the international volt remains uncertain by a quantity greater than the inaccuracy of making a measurement.

The conditions which have led up to the present joint investigation are detailed in a statement on another page by the secretary of the International Committee. The purpose of this investigation is to formulate specifications both for the use of the silver voltameter and for the construction of the standard cell, the latter being important in that it fixes the numerical value which will apply to the Weston cells which are used so generally in commercial work. At the London Conference, a provisional value of 1.0184 volts was adopted for the saturated Weston cell, and this has been made legal in England. It now seems probable that this value will have to be changed when the final specifications are completed, in order to bring it into agreement with the fundamental definition of the volt in terms of the ohm and ampere.

In this country the units adopted in 1894 as the result of the Chicago Congress are still the legal units. The law which put them into effect is ambiguous in that it gave concrete standards for ohm, ampere and volt, and also defined the volt in terms of the ohm and ampere. It consequently was left to administrative procedure to follow the one or the other definition of the volt, and the Bureau of Standards, having jurisdiction over this matter, chose to follow the concrete definition of the volt; and furthermore has made the ampere depend upon this value. There is consequently at this time a discrepancy between this country, England and Germany in the recognized values of both volt and ampere, and since both enter into the determination of the watt, the discrepancy in it is even larger. A wattmeter which has been adjusted to read correctly in Germany will read one-tenth per cent low according to the standards used in this country,—a quantity easily detected and readable on a portable wattmeter.

The sooner this condition can be remedied and international uniformity really secured, the better will conditions be for the electrical industries. It is to be hoped that this will follow from the present investigation, for as soon as the specifications in question can be settled it will be in order for our own Government and also the other governments concerned to pass a law legalizing the concrete standards established by these specifications.

That the importance of this question is realized by our leading engineers is evidenced by the action of the several national societies in assuming the financial burden of the work.

ELECTRICITY FROM WASTE HEAT.

It is not in the order of human events to obtain something from nothing, but it is often possible, by the use of sufficient aforethought, inventive ability, and business acumen, to turn a seemingly valueless by-product into products of commercial utility. The history of the coal-tar industry and of synthetic chemistry affords many instances of this. Another, and one of vital interest to the electrical engineer, is the utilization of the heat and potential energy of the gases from coke ovens and blast furnaces.

A striking example of the value of the gases from blast furnaces is furnished by the use of what has been made of these by-products in the steel mills of Gary, Ind., and at some other places. In some of the coal-mining districts of Pennsylvania, too, the gases from coke ovens have been put to use, albeit in a more or less desultory manner, in generating electrical energy. But these are only a few instances out of the many possible, where much profit is available by looking closely to the opportunities for commercial exploitation of valuable by-products.

In England, as far as utilizing the waste heat from coke ovens is concerned, more real work seems to have been done than here in America. At the third annual general meeting of a company known as the Waste Heat and Gas Electrical Generating Stations, Ltd., held in Newcastle-on-Tyne, England, February 28 last, its chairman, Mr. J. B. Simpson, said that the results of the year had been most satisfactory, inasmuch as a profit of $83,655 has been earned on a paid-up capitalization of $750,000. This was in spite of the fact that one of the smaller generating stations, which it had been expected would have been running several months ago, was not yet in operation. The directors recommended a dividend of seven per cent and increased the nominal capital of the company by $500,000 so as to be able to increase further its field of activities. This company utilizes the waste heat from the coke ovens of several companies in the county of Durham.

The chairman, in moving the adoption of the report, said that it was now amply proved, and appreciated by those who had agreements with them, that without such a company as this and without the electric power companies, it was not possible for the owners of waste heat to use this commodity economically or to make anything like the same profit out of it.

Without necessarily concurring with the above remarks (for in some cases, as at Gary, conditions are advantageous to a company utilizing its own waste heat), it might be well to point out that in several regions in the United States there exist ample fields for companies such as the one in England remarked above; and even if in any of these dis-

tricts there should exist already a modern generating station quite capable of efficiently catering to the electrical needs of its immediate territory, there is plenty of room for the establishment of electrochemical and other industries which would utilize to advantage the electrical energy which can be generated from the gaseous by-products of the blast-furnaces and coke ovens, now going to waste.

THE MARKET FOR HYDROELECTRIC POWER IN THE OLD SOUTH.

A single transmission company earned more than $800,000 last year by the sale of hydroelectric power in the Old South.

This income came from a part of two states, and there is opportunity to multiply it a number of times from Virginia to Mississippi.

In this Old South of the colonial days both the undeveloped water powers and the present and prospective manufacturers invite the transmission of hydroelectric energy on a great scale.

This region is traversed from the Appalachian Mountains to the sea by a dozen large rivers that fall one to several thousand feet from their sources and are fed by a rainfall of forty to fifty inches annually. On their way to the ocean these rivers cross a territory that contains probably one-third of the standing timber in the United States, one-half as much soft coal lands as Pennsylvania, and the greatest remaining deposits of iron ore, and that produces annually three-fourths of the cotton crop of the world.

Cheap power and transportation have been lacking for the full development of these great natural resources, but this condition is being remedied by the transmission of energy from the rivers to the lines of railway and the mines. Hardly more than a decade has passed since electric transmission began here, but enough has been done to show that great opportunities for hydroelectric power await development.

As to the locations of water powers and the transportation systems, the general situation is that the railways do not follow the river valleys, but cross them and the ridges, so that most of the water power sites are distant from the railways and the cities. Add to this the fact that steam coal costs $3.00 to $3.50 per ton over most of this territory, and that the heavy, bulky nature of the raw materials used tends to develop manufacturing plants of relatively small capacity near the points of production, and the unusual market for transmitted hydroelectric power is readily understood.

While a good start has been made in several sections of the Old South toward the supply of manufacturers with hydroelectric power, it is safe to say that only a minor part of the total requirements at the present time are met in this way, though it has been estimated that the rivers represent 2,000,000 horsepower for development.

The demand for raw materials alone is rapidly forcing up their production in the Old South, and in the elementary processes of mining, quarrying, the sawing of lumber, and the transportation of products to the steam railways, a large amount of hydroelectric power can find a market. Probably no section of the United States with equal population is so poorly supplied with interurban electric railways as this Old South, and the transportation of cotton and other products to the steam roads would yield a substantial revenue item in some localities.

In 1890, the production of cotton in the United States was 8.5 million bales, or more than in any previous year, but in 1908 it was 13.5 million bales, and the major part of this crop came from the Old South. Starting again with 1890, the South produced 2.6 million tons of pig iron, mined 21.2 million tons of coal, and cut timber to the value of 90.7 million dollars. For the year 1905, the corresponding figures were for pig iron 3.1 million tons, for coal seventy million tons, and for lumber products a value of 250 million dollars.

With this increasing production of raw materials the Old South is turning greater percentages into the finished products. Comparing the year 1890 with 1905, the number of cotton-oil mills in the South increased from 119 to 780, and the capital invested in them from twelve to fifty-four million dollars. During this same period, the number of cotton spindles in southern mills rose from 1.7 million to 9.2 million, and the consumption of cotton in these mills from 0.5 million to 2.1 million bales. That much room for expansion of southern cotton mills still remains is evidenced by the fact that the consumption of 2.1 million bales there was only one-fifth of the production.

In the single state of North Carolina, from 1899 to 1908, the number of cotton mills increased from 215 with equipment of 51,472 horsepower to 352 with equipment of 133,851 horsepower. For the earlier year the spindles numbered 1,115,820 and the looms 25,943, while in the latter year there were 3,110,099 spindles and 54,812 looms. All the factories of this state numbered 441 and were equipped with 68,209 horsepower in 1900, and the number had increased to 1,053 with 263,121 horsepower in 1908.

In the Piedmont section of North and South Carolina there are now more than 400 textile mills with an estimated equipment of fully five million spindles, and more than one hundred of these mills are operated with hydroelectric power.

In a section of Georgia including Macon and Atlanta and not over one hundred miles square there are now completed and under construction about fifty cotton and yarn mills, and these mills are operating more than 200,000 spindles and nearly 5,000 looms.

From this brief review of the natural and industrial conditions in the Old South, it is evident that the water power is there, the raw materials are there, and there also are manufacturers that offer a market to hydroelectric energy.

Commercial Day, National Electric Light Association Convention.

Commercial Day promises to be a bigger feature of the 1910 National Electric Light Association convention, St. Louis, May 23-28, than in any previous year. The programme committee has arranged for a series of papers which deal with larger aspects of the commercial problem and the discussion will bring out phases of new business department work not heretofore touched at these sessions. The programme tentatively announced is as follows:

"Residence Lighting," by H. J. Gille.

"Latitude in Commercialism," by Arthur S. Huey.

"Industrial Lighting with Incandescent Lamps," by H. S. Hall and P. F. Bauder.

"Off-Peak Load," by R. S. Kelsch.

"Prompt Execution of Orders," by Clare N. Stannard.

"A Plan to Interest National Advertisers in Electric Publicity," by Frank B. Rae, Jr.

"Advertising," by C. W. Lee and H. K. Mohr.

"Ornamental Street Lighting," by E. L. Elliott.

"Commercial Department Organization," by T. I. Jones.

"Electric Automobiles," by Hayden Eames.

In addition to the above it is possible that a paper on "The Effect of High-Efficiency Lamps on Central Station Income" may be secured.

While the plans of the committee are yet in a formative state enough has been done to insure a most successful and instructive commercial day. The old idea that these sessions should be given over to nothing practically but papers and discussions or soliciting and advertising has given place to a new policy. The plan of this year's programme is much wider, tending to show that central station commercialism instead of being a mere side issue of the business is in reality of equal scope and importance with both public policy and engineering.

Among the papers which will be presented, especial attention might be called to the one on "Industrial Lighting with Incandescent Lamps," which is being prepared by a committee of illuminating and commercial engineers of the National Electric Lamp Association. This paper promises to be, in effect, a text book on industrial lighting and will cover every phase of this important subject. It will be very fully illustrated with views showing both good and bad methods and will contain not only specific instructions as to how these installations should be made but will give the whys and wherefores.

Mr. Arthur S. Huey's paper on "Latitude in Commercialism" will also attract much attention. Mr. Huey, as vice-president of H. M. Byllesby & Company of Chicago, has had wide experience in supervising the management of plants controlled by his organization. His views upon the qualifications of a successful central-station manager are radical, to say the least, as he considers the ability to understand or draft a franchise to be of quite as much importance as the ability to plan the enlargement of a power plant, and gives greater credit to the man who can "handle" a newspaper reporter than to the man who reduces the fuel costs.

The papers on electric advertising, automobiles and street lighting will bring these subjects down to date and show the latest successful practices in enlarging these departments of the business.

The committee having charge of this year's commercial programme consists of: George Williams, chairman; J. F. Becker, J. Robert Crouse, H. J. Gille, C. W. Hare, V. A. Henderson, Arthur S. Huey, Percy Ingalls, C. W. Lee, E. W. Lloyd, H. K. Mohr and Frank B. Rae, Jr., secretary.

Commission News From New York.

The New York Public Service Commission, second district, has authorized the Hoosac River Electric Light and Power Company to issue its capital stock in the amount of $15,000, to be sold at not less than par. The proceeds are to be used for discharging indebtedness incurred in erecting its plant at Valley Falls, the expenses incident to further construction and extensions in that village, and the cost of necessary equipment for a distributing system in the village of Schaghticoke, authority has also been given to said company to exercise franchise in the village of Schaghticoke, granted to it by the Board of Trustees.

The commission has dismissed the complaint of residents of the city of Ithaca against the Ithaca Street Railway Company, as to alleged unreasonable and excessive rate of fare charged by it between the East Ithaca station on the Elmira, Cortland and Northern branch of the Lehigh Valley Railroad and other points within the city of Ithaca.

The commission holds that section 101 of the railroad law permits that company to charge a ten-cent fare in each direction, but that said fare is subject to reduction under and by reason of the enactment of the public service commission law; that the service rendered by the company between points in Ithaca and the East Ithaca station as now rendered is a special service as distinguished from the regular city service, involves transportation upon a line having an elevation of more than 450 feet within a distance of one and one-half miles, and the ten-cent fare in force affords small return to the company above the cost of operation. The commission holds that under present conditions the ten-cent fare for the service rendered is not unreasonable or unjust.

The commission has also authorized the Hornell Electric Company to issue 175 shares of its common capital stock and to exchange the same for certificates of indebtedness issued on May 1, 1908, and maturing May 1, 1931.

The commission has authorized the Corning Gas and Electric Company to exercise franchises in the hamlet of Gibson, Steuben County.

The Fulton County Gas and Electric Company has been authorized to issue its three-year, six per cent gold bonds for the aggregate principal sum of $99,000, the notes to be dated March 1, 1910, and to be redeemable at the option of the maker any time after September 1, 1910. The notes are to be sold at not less than par. The proceeds are to be used for extension and improvements to the gas and electric properties of the company in Johnstown and Gloversville.

Harper's Bazaar for April, one of the very popular fashion magazines, contains an interesting article by Helen Lamborn, entitled "Electricity for Domestic Uses." The author indicates the utilitarian advantages of electrical heating and cooking devices, and shows where the task of the housekeeper can be lightened and the work also made very pleasant through the use of the vacuum cleaner, electrically driven bread mixers, scouring implements, and the many handy devices which the manufacturers are placing upon the market.

Chicago Electric Club.

At the regular mid-day meeting and luncheon of the Chicago Electric Club on Wednesday, March 30, an admirable address was made by John F. Gilchrist, assistant to the president of the Commonwealth Edison Company, on the subject "The Time Element."

Mr. Gilchrist's remarks did not deal with the time element as it appears in engineering or scientific endeavor, but rather with the time element as it affects the life and work of men engaged in every phase of industry. He emphasized the necessity for a strict adherence to certain definite codes of procedure in the handling of business, and intimated the great economical losses which were sustained, due to a lack of appreciation on the part of business men of the importance of the conserving of the time element.

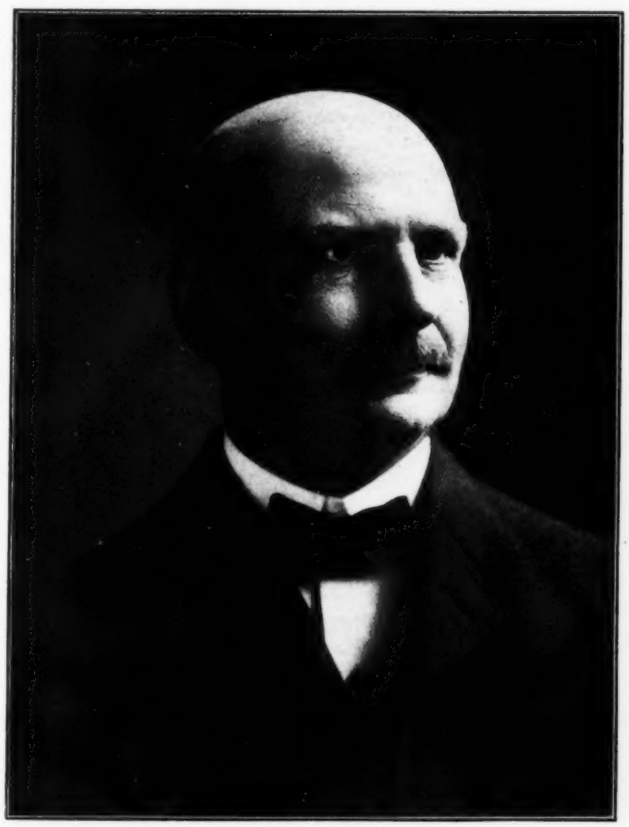
Speaking in general terms, he indicated the difference in the time element of a manufacturing concern and the public service corporation. With the former, upon a capitalization of $1,000,000 it was common to turn this capital over six or seven times within a year, while with the public service corporation with a capitalization of $60,000,000, it took from six to ten years to turn this capital over once.

In the contracting and building business also the time element was of vital consideration, in the case of a large office building or a new hotel, the postponement of opening might involve easily as much as $1,000 a day to its promoters. Also in the transportation of delivered goods, the utilization of electric vehicles in place of horse-drawn equipment involved a serious consideration of the time element, the raising of the efficiency of the equipment in a slight degree bringing about remarkable changes in the economy of the system and in the service to customers.

Following the address several members of the club congratulated Mr. Gilchrist upon his choice of a subject, and he was tendered a rising vote of thanks.

Belvedere Brooks.

Mr. Belvedere Brooks, formerly general superintendent of the Eastern Division of the Western Union Telegraph Company, was recently elected general manager of the same company. The excellence of this choice will be appreciated by the telegraph fraternity throughout the country. Mr. Brooks has been identified with the Western Union for nearly forty years, is familiar with the business in every phase, and is today a good telegraph operator, not having forgotten, as one seldom does, his expertness at the key.



BELVEDERE BROOKS.
Who Was Recently Made General Manager of the Western Union Telegraph Company.

Mr. Brooks came to New York from Denver about ten years ago. He began his telegraph work in Texas, in which state he was born in 1859.

Official announcement of Mr. Brook's selection was made from the offices of the Western Union company, at 195 Broadway, New York city, as follows:

"At a meeting of the directors of the Western Union Telegraph Company, held today, B. Brooks, general superintendent of the Eastern Division, was appointed general manager of the company. He will assume charge of the operating end of the business immediately, so that President R. C. Clowry may devote more time to administrative matters and to working out the new management. The vacancy caused by Mr. Brooks's advancement will be filled from the ranks by the promotion of A. G. Saylor, now assistant general superintendent, to become general superintendent of the Eastern Division.

"General Manager Brooks, who came to New York from Denver, has been with the Western Union company nearly forty years, starting as a messenger boy and working his way up through the ranks. His promotion is the first important change since the new interests came into the board."

An excellent portrait is presented on this page. Mr. Brooks is a gentleman of powerful physique and great energy, and his increased responsibility is the proper appreciation of loyal, able administrative services in the past.

New York Electric Companies Show Increased Profits.

The New York Public Service Commission has published figures compiled from the annual reports showing the principal operation during 1909, of the electric light and power companies of the city, these being ten in number. They are the New York Edison Company, the United Electric Light and Power Company, the Long Acre Electric Light and Power Company, the Bronx Gas and Electric Company, the Edison Electric Illuminating Company of Brooklyn, the Flatbush Gas Company, Power Company, the Queens Borough Gas and Electric Company and the Richmond Light and Railroad Company. The net income of the New York Edison Company from all sources was $4,719,807, representing more than ten per cent on the capital stock of the company. The total net income from all sources for all of the companies is given as $5,553,429, an increase of $1,164,211 over the previous year's figures.

Railway Situation in Toledo.

The street car problem in Toledo is fast approaching a climax. On about nine miles of the sixty-eight miles of streets occupied by the tracks of the Toledo Railways & Light Company, the franchises will expire in a few months. The city administration was elected on a three-cent fare platform, and all efforts to get together on the problem of renewing franchises have thus far been futile. In a long letter to the city council submitted this week by President Albion E. Lang of the company, he asks that the matter may be taken up immediately and settled, because the present unsettled condition makes it impossible for the company to secure money with which to make many needed improvements for the bettering of the system. One of the first questions which will be solved will be whether a renewal of existing franchises will be considered, thus shutting out competitive bids, or whether competition will be opened for new franchises altogether. Petitions are in circulation in the city asking the council to act immediately in securing competitive bids, but they are not heavily signed. It is apparently certain that the company will be reorganized after the franchise question is settled, and stock will probably be reduced, but all present stockholders will be protected. In the meantime the street car company's portion of street paving is piling up and now amounts to about $45,000, because of lack of funds. Other paving improvements are being held off because of the uncertainty, involving the expenditure of many thousands of dollars. Announcement was made recently of the appointment of Rathbun Fuller as legal representative of the company, taking the place of Barton Smith, recently retired. Fuller is a member of the law firm of Swayne, Hayes, Fuller & Tyler. Hayes, another member of the firm, recently accepted a position as first assistant city solicitor. H.

Funds for Subway Construction.

It is probable that $60,000,000 of the New York city's money will be set aside this year for rapid transit construction. There has been a conference between the Board of Estimate and the Public Service Commission, and it has been agreed that contracts for the above amount can be entered as soon as the enabling act is passed.

The total amount of money to be released for rapid transit, dock and water purposes under the constitutional amendment before the legislature will be $100,000,000. Of this $46,000,000 will represent the amount invested by the city in the present subway, and there will be $40,000,000 additional to be released from the dock fund, which is self-sustaining up to the extent of at least $50,000,000.

American Telephone Stock Increase.

Stockholders of the American Telephone and Telegraph Company at special meeting authorized an increase in the capital stock from $300,000,000 to $500,000,000. They also voted to increase the number of directors from eighteen to twenty-five.

The number of shares represented at the meeting was 1,477,756. The vote in favor of the increase in capital stock and of the increase in the number of directors was unanimous.

At the annual meeting directors were re-elected. The seven new directors, who will be added to the board, cannot be elected until after the resolution changing the by-laws has been filed at Albany.

Officers of the American Telephone and Telegraph Company have been re-elected.

Trade Between United States and Canada.

A recent report of the Bureau of Statistics, Department of Commerce and Labor, shows that in 1909 over $4,600,000 worth of copper was imported into the United States from Canada. The table of exports, however, shows that the United States sent to Canada $11,200,000 in machinery, $2,500,000 in various copper manufactures and $1,500,000 in electrical instruments.

Telephone Companies Not to Unite at Present.

In regard to the recent rumors that the Chicago Telephone Company was to be merged with the Central Union Telephone, President B. E. Sunny, of the Chicago Telephone Company, states that it is the policy of the American Telephone and Telegraph Company to segregate its various subsidiary corporations along state lines but that there is no more on foot at the present time to unite the Chicago and the Central Union Companies. Such a move has long been considered probable and Mr. Sunny is authority for the statement that it is perhaps nearer actual completion than it has been before.

As to business of the local company Mr. Sunny says that the same rapid and steady growth which characterized 1909 is now evidenced.

Fourth and Madison Avenue Railway.

Judge Lacombe, in the United States Circuit Court, has signed an order directing Joline and Robinson, as receivers of the Metropolitan Street Railway Company, to expend out of the moneys in their possession $313,900 to restore the lines and property of the Fourth and Madison Avenue Railway to a state of good working order. The order is granted on the petition of the New York and Harlem Railroad Company, and is agreed to by the Guaranty Trust Company, of New York, the New York City Railway Company, and W. W. Ladd, receiver, the Pennsylvania Steel Company, John D. Crimmins, the Central Crosstown Railway Company, and the Morton Trust Company.

Interborough Subway Plans.

The Interborough Rapid Transit Company, of New York city, will submit a new subway plan to the New York Public Service Commission within the next three weeks. The routes are as follows: From the Grand Central Station up Madison Avenue to the Bronx; from the Times Square Station down to Thirty-fourth Street there connecting with the Pennsylvania Terminal; terminating in Brooklyn by means of another East River tube. This will be known as the Pineapple Street route and will extend out Flatbush Avenue to Prospect Park.

Whether the Interborough will include in its offer a plan for operating the Steinway tunnel is unknown. The tube has been idle since its completion in 1907 at an annual loss to the Interborough on account of interest on money advanced to the amount of $429,775.

General Electric to Enlarge Plant.

It has been officially announced that the General Electric Company will spend $500,000 this year in adding new works to its Stanley plant. Three contracts for buildings to cost $200,000 have already been let. These call for an annealing building to cost $40,000, a pattern storage building to cost $100,000, and a building to double the capacity of its power plant to cost $60,000.

Southern Convention of American Institute of Electrical Engineers.

Large Meeting Held at Charlotte, N. C., March 30, 31 and April 1.

A departure from the ordinary routine meetings of the American Institute of Electrical Engineers was taken when it was decided by the Board of Directors to accept the invitation of the officials of the Southern Power Company and hold a special convention in Charlotte, N. C., early this spring. The date of the meeting was set for the last two days of March and the first day of April. A programme of seven papers was arranged and several social events, as well as visits to industrial plants were planned, the most important of these being a trip to the Great Falls and Rocky Creek plants of the Southern Power Company.

A goodly number of members of the Institute and guests reached the Selwyn Hotel, the headquarters for the meeting, on Wednesday morning, March 30, but as one of the trains from the North had been delayed it was decided to postpone the session scheduled for 11 a. m. to 2 p. m., thus combining the morning and afternoon sessions of Wednesday. The success of the convention seemed assured from the start, as 300 members and guests registered during the day.

WEDNESDAY AFTERNOON SESSION.

The first session of the convention was called to order at 2:30 p. m. in the assembly room of the Selwyn Hotel, by President L. B. Stillwell, who introduced W. S. Lee, chief engineer of the Southern Power Company and chairman of the local committee. Mr. Lee, after expressing his pleasure in having the Institute meet at Charlotte, introduced T. W. Hawkins, mayor of Charlotte, who welcomed the Institute to the city. He spoke briefly of the rapid growth of Charlotte, and the great development of its industries which is now going on, and pointed out the large and important influence which electrical power is having in this growth. The city has now a population of 50,000 and is the largest user of electric power in the South. It therefore seems a most appropriate place for a convention of the American Institute of Electrical Engineers, and he assured the members that their welcome was as sincere as it was hearty.

President Stillwell thanked the Mayor for his cordial welcome and assured him, in return, that the Institute was greatly pleased by the opportunity to visit a Southern city which represents one of the four sections of the country where important hydroelectric developments are going on.

President Stillwell announced that this meeting marked a departure in the policy of the Institute. This society has become so large and influential that it is now really continental and, in view of this fact, it seems only just that meetings should be held outside of New York. Hereafter, whenever a member has prepared a paper of Institute grade, a meeting of the Institute may be arranged at a suitable place for its presentation and when possible a representative of the Institute will be sent to preside. It is expected that this plan will stimulate the preparation of good papers. The present meeting served to emphasize the importance of power in industrial development, particularly in regard to cotton mills.

In the utilization of a resource, such as water power, it is necessary not only to secure the capital necessary for the work, but to get together a staff capable of carrying out the work. In this the Southern Power Company had been brilliantly successful.

Albert Milmow then presented in abstract his paper entitled, "Electric Drive in Textile Mills."

ELECTRIC DRIVE IN TEXTILE MILLS.

This paper treats of the driving of textile mills by electric power from hydro-electric systems, and refers particularly to its commercial aspects and compares especially with the old forms of steam drive. With regard to the first cost of installation for a plant of 25,000 spindles requiring a power equipment of about 1,000 horsepower, the whole of the apparatus for electric drive, including transformers and house therefor, shafting, boilers, piping, motors, switchboard, wiring and installation (including lighting), etc., for a 2,300-volt supply, works out to $33,897, while for mechanical drive and auxiliary electric lighting the cost is $79,043. All possible costs are included in these figures, which show for electric drive a cost of $33.90 per horsepower, as against $79.00 per horsepower for steam drive—a saving of $45.10 in favor of electricity. The costs of operation were shown to be difficult of comparison, as with electricity the absolute horsepowers and the indicated horsepower can be determined at any time, thus affording opportunities to check wastes and correct them, a condition of affairs which does not obtain when steam drive is used. Moreover, with electric drive, the elimination of useless shafting does away with a considerable amount of non-productive power. The comparison proved in favor of electric drive. The facility for overtime or extra work in one or more departments afforded by the use of electric drive, which is increased by employing extra motors, is lacking in mills using steam drive; one reason being that steam engines are inefficient on any but their normal loads, whereas with electric power as much power as is required can be taken anywhere at any time. Another important advantage of electric drive is the ease with which extensions can be made at any time. If a mill is designed for steam drive and allowance is made for expansion, it means that the steam equipment must be made larger than that which is required for immediate needs, the extra plant being unproductive at first and adding to the cost of running. With steam drive too, the engine and boiler plant being first decided upon, the mill has to be built to suit this machinery, while with electric drive this is a secondary consideration or does not matter at all. A large number of curves were given to show the very material improvement afforded by electric drive over steam drive in regard to initial speed and transmitted speed. With large hydroelectric systems supplying a group of mills, the switching on or off of a motor or motors in any one mill makes a very small disturbance on the whole system, while with mechanical drive for even a large single mill the cutting in or out of even one machine might greatly affect the power available for the rest of the machines. Again, with converted mills, carefully kept records showed in every case an increase in production of from two to ten per cent by the change over to electric drive. In conclusion, a plea for the use of high-voltage system (2,200 volts preferred) was made, as the troubles from burnouts (common in low-voltage systems) were thereby practically eliminated. By using automatic oil switches and earthing the iron or steel conduit in which the wiring is run, almost absolute safety is assured.

C. F. Scott opened the discussion by pointing out the importance of the incidental gains secured by the adoption of the electric drive. While the electric motor did furnish power at a lower cost than steam, the gains due to greater steadiness and higher permissible speed were much more important. The electric drive also offers better opportunities for future growth.

W. S. Lee called attention to the importance keeping records of the power consumption of the mill, as this is a true indication of the production of the mill. He also emphasized the value of uniformity of speed as this affects directly the quality and quantity of the product. If the mill showing a speed variation of sixteen per cent should be converted to the electric drive it would show an increase in output of eight or ten per cent.

A. W. Henshaw gave some interesting statistics, taken from the United States census reports of 1900 and 1905 showing the increase in the use of

power in all industries. This has been particularly noticeable in North and South Carolina, where the cotton mills form the most important users.

D. B. Rushmore said that there are few industries today into which electric power has not been introduced. However, the true function of electricity is not always clearly understood. This is the supplying of power. It is true that it is cheaper for the mill operator to buy his power than to make it himself, just as it is cheaper for him to buy his machines than to manufacture them in his mill. This fact is well brought out in the paper.

E. D. Latta, Jr., read an abstract of his paper entitled "Gas Engines in City Railway and Lighting Service."

GAS ENGINES IN CITY RAILWAY AND LIGHTING SERVICE.

This paper gives: (1) A description of the plant of the Charlotte (N. C.) Electric Railway Company, which uses gas engines for prime movers, and furnishes current for street railways, electric lighting, and small-motor service; (2) data from the daily operating reports, on the reliability, efficiency and adaptability to severe working conditions of the plant; (3) data on the subject of producer-gas manufacture; (4) some remarks on the utility of gas engines for certain kinds of works. The engine room equipment consists of two 810-brake-horsepower, horizontal, twin-tandem, double-acting, four-stroke gas engines and one sixty-horsepower, single, tandem, exciter engine. The 540-kilowatt, three-phase, sixty-cycle, 2,300-volt alternators are direct and rigidly connected to the crankshafts of the main engines, and a forty-kilowatt direct-current generator is direct-connected to the exciter engine. In addition to this apparatus there is an induction motor-driven exciter set of the same capacity as the engine exciter, a 300-kilowatt and a 500-kilowatt rotary converter, and the usual switchboard equipment. The producer apparatus is contained in a building about one hundred feet from the power house, and consists of two 1,000-horsepower units of twin generator down-draft producers, having a continuous overload capacity of fifty per cent. Each unit consists of two nine-foot generators, sixteen feet high, having a fuel space seven feet in diameter by eight feet high above the grate bars, which are of arched fireclay tile. The generators are connected at the bottom by openings, lined with firebrick, containing water-cooled gate valves, to an economizer or vertical boiler of 100 horsepower rating. From the top of the boilers a sixteen-inch pipe leads to the bottom of the wet scrubber and from the top of the wet scrubber to the exhauster, or through a by-pass around the exhauster to the dry scrubber. A 60,000-cubic-foot holder receives the gas from the producers and delivers it to the engines. This plant is being operated at present under a poor load factor, but the author claims that an increase of twenty-five per cent in the load factor can be met by an increase of only ten per cent in the operating costs. His conclusions are given in full, as follows: That the gas engine has a wide field of usefulness is no longer disputed, but whether it is adapted to conditions of operation such as are met in the plant described is very questionable, unless it be in connection with a storage battery. Other factors, however, than the conditions of load, as in this case, often enter into the question, and bring influence to bear upon the adoption of a system seemingly unsuitable for the conditions in hand. The economy of the gas engine has long been conceded, and its reliability at the present time has been proved without a shadow of doubt. An engine in the Edgar Thompson Works of the U. S. Steel Corporation has operated continuously night and day for six months with the total loss of only three hours time; and other records that would do credit to any class of prime mover are to be had in numbers. When a source of power at low price but uncertain continuity is available, a gas engine and producer will prove a most perfect relay, provided the character of service will warrant the cost of reserve power. With the holder full of gas and the exhauster of the producer stopped, the fires in the generators will smoulder with almost inappreciable standby loss. The engine may be started and put under load in less than two minutes, and the producer can be brought up to working condition before the gas in the holder is exhausted. Again, when natural or blast-furance gas is available, or when location renders the cost of fuel high, the gas engine has no competitor. Fuel can be utilized in the producer that is absolutely unfit to be burned under a boiler, but even where conditions are more favorable to steam, the gas engine makes a most respectable showing.

There was no discussion on this paper as the meeting adjourned and the members visited the station which had just been described, and also various of the textile mills at Charlotte, special cars being provided for these trips.

WEDNESDAY EVENING SESSION.

At the Wednesday evening session but one topic was taken, this being the experimental lecture by E. E. F. Creighton on "Some Demonstrations of Lightning Phenomena." The lecturer introduced his subject by stating that the aluminum electrolytic arrester, in one form or the other, is the solution of the problem of protecting high-tension lines. However, each application of the arrester requires special treatment, and the method of protecting underground cables, for instance, is entirely different from that of protecting overhead lines. In all cases it is not sufficient to connect one aluminum arrester between each line and the ground as a dead ground on one line then throws the entire potential of the system on the other two arresters, which is more than they are intended to withstand. Mr. Creighton then showed the "formation" of the aluminum cell at different voltages. The limiting potential for a single cell is about 330 volts. This is called the permanent voltage. The "formation voltage" is that applied to the cells when they are formed and the film thus secured is only strong enough to withstand that potential. Therefore, any rise in potential above this finds the arrester ready to allow a discharge. Hence, it is desirable to reform the arresters in use at least once a day.

The effect of heat in dissolving the film was pointed out and the effect of adding impurities to the electrolyte shown. Chlorides are the worst materials to get into the cells.

The effect of high resistance in destroying spark discharges of low frequency was shown, but it was also shown that each such resistance has an equivalent air gap across which the spark will jump even though the gap be shunted by the resistance of the frequency of oscillation of the discharge be high. An induction behaves in a similar way, causing the discharge to seek some other path than that through the coil. Hence choke coils are useful for preventing such high-frequency surges from getting into the station. But if the surge takes place at a low frequency the coil is less effective. The jumping of a spark across the end turns of a coil was also shown very prettily. Such sparking does not burn the insulation, though it tears it and it may cause the dynamo current to follow over and thus short circuit the end turns.

The effect of breaking up a gap into a number of shorter ones was shown, the equivalent gap of a multigap arrester unit was found to be about 1.8 inches, while the sum of the individual gaps is only about half this distance. Such arresters may fail if the frequency of the oscillation be low, as the arrester is not sensitive to such effects, though it is sensitive to high-frequency oscillations. The aluminum arrester is equally sensitive to all frequencies.

The characteristics of the electrolytic arrester were shown by finding the equivalent spark gap of a pair of copper plates placed in pure water. But as soon as a little salt was added to the water there was practically no equivalent gap. The equivalent gap of an alumninum cell is only a few thousandths of an inch. These characteristics show that to get a good ground it is essential to place the ground plate in mud. Water alone will not answer. The resistance of the electrolyte must be low.

Mr. Creighton brought his lecture to a close by showing the effect of inductance of the arrester connections by finding the equivalent gap of eight feet of wire. This was about one-half inch, although the resistance of the wire was negligible.

The evening session was then adjourned.

THURSDAY MORNING SESSION.

The Thursday morning session was called to order by President Stillwell and Dr. Carl Hering was called upon to read his paper entitled "The Proportioning of Electrodes for Furnace Electrodes."

PROPORTIONING FURNACE ELECTRODES.

This paper gives a general view of the investigations made by the author to determine the correct principles for proportioning electrodes. His results show that these differ radically from the methods heretofore employed. The fundamental principle of his analysis of the problem is that the heat gradient at the hot end shall be zero. This can only be obtained by having the temerature of the hot end equal to that of the furnace, a condition which can be obtained by securing the proper current density in the electrode. The method of investigation was first analytical and the results thus indicated were then tested experimentally. Many experiments were made, the data of which are given to determine the constants involved in the equations enunciated. The important points brought out by this study are that the electrodes shall not chill the furnace; the length of the electrode is determined by the thickness of the furnace wall; its cross section by an equation bringing in the furnace temperature. The loss in watts is independent of the cross section or length. The hotter the outside terminal the smaller is the loss. The diameter of the external portion of the electrode necessary for making connection are determined by different laws. Graphite forms the best electrode material, carbon the poorest.

A paper by A. E. Kennelly, entitled "Modifications in Hering's Law of Furnace Electrodes," was read in abstract by Mr. Hering.

MODIFICATIONS IN HERING'S LAW OF FURNACE ELECTRODES.

At the meeting of the American Electrochemical Society in October 1909, a paper was read by Carl Hering on "Laws of Electrode Losses in Electric Furnaces." At least seven interesting and important laws of electrode losses were enunciated and demonstrated in that paper, of which, however, only the two following need here be considered:—(a) The combined loss through the cold end of an electrode is equivalent to the sum of the loss by heat conduction alone, (when there is no current) and half the I^2 R loss. (b) This combined loss will be least when the loss by heat conduction alone is made equal to half the I^2 R loss; the total loss will then be equal to the I^2 R loss, and no heat will be conducted from the interior of the furnace.—In the discussion on the paper the question was raised as to how far the temperature variation in electric and thermal resistivities of the electrodes modified these laws, since these resistivities might be considerably different at the hot and cold ends. This paper is devoted to a consideration of that question from an arithmetical point of view. As a result of his analysis and with the assumptions he has made the author proposes to amend Mr. Hering's laws as follows, to meet the conditions of variable thermal and electrical resistivity. (a) The combined loss through the cold end of an electrode is equivalent to the sum of the loss by heat conduction alone (when there is no current) and approximately half the I^2 R loss, the exact fraction depending on the temperature coefficients of the resistivities. With constant resistivities, the fraction will be one-half. (b) The above combined loss will be least when the loss by heat conduction alone is equal to the joulean loss through the cold end. The total loss will then be approximately equal to the total joulean loss and very little heat will flow into or out of the furnace. With constant resistivities, this resultant furnace flow will be nil.

Mr. Hering then read an abstract of Doctor Kennelly's discussion of the former's later paper. By plotting the changes in thermal resistivity it is found that these follow a straight-line law.

Mr. Hering also abstracted a written discussion of his paper, contributed by Dr. E. F. Northrup.

President Stillwell pointed out the opportunity for the use of electric furnaces in the South where power is cheap.

W. S. Lee was then called upon to read his paper entitled "Economies of Hydroelectric Plants."

PARALLEL OPERATION OF HYDROELECTRIC PLANTS.

This paper treats of the advantages to be gained by operating a system of hydroelectric plants connected in parallel so as to exchange power from one plant or territory to another, the deductions being drawn from conditions existing on the southern slopes of the Appalachian mountains. With a number of plants located on the same stream, a variation of rainfall at the different points may be compensated for by passing water from one reservoir to another, so as to produce the greatest kilowatt-hour output from the combined plants. Where the plants are located on different streams the effects of low water and of high water are minimized, for it is rare that a low rainfall or a flood will occur in several different localities (not on the same stream) at once. Furthermore it is evidently advantageous to have a chain or system of plants in connection with the storage of water. Thus plants with large reservoirs can be called upon to supply extra current for peek loads, and extra equipment for this purpose in any single plant is thus rendered almost unneccessary; also, the problem of auxiliary steam plant is much simplified. Another advantage of the combined plants is that a much better load factor is obtainable on the whole system than on any particular plant by itself. Again, when a plant is to be built on a stream on a site below that already occupied by another plant, the flow of the river can be regulated while the coffer dams and difficult parts of the foundations of the new plant are being put in. Regarding the cost of attendance for a system of plants, it is an advantage to have one practical operating man at the head of the whole organization instead of several operators distinguished at the various plants, and furthermore the stations can be so manned that twenty-four-hour shifts are not necessary at all of the plants, at least during the building up of the load. Other advantages of the combined system are: (1) Ability to furnish better service; reduced cost of transmission system; better facilities for serving consumers to the best advantage as when these require extra power; various constructing and operating advantages. The author closes with some views on the general conditions pertaining to the waterpower situation at the present time.

The discussion was opened by C. E. Waddell, who said that Mr. Lee had put the matter clearly, but he might have added more about the advantages of development by one large company. These are—greater reserve, the effect of starting single units is not felt, rates are uniform and the customers have the advantage of the best engineering advice in selecting the equipment. In order that such developments may be carried out in the best manner for the entire community the company should have the right of eminent domain.

Percy H. Thomas asked Mr. Lee how the speed of the different stations and the voltage of the system were controlled. Is it possible to cut out one station without affecting the system as a whole? Has it been practical to build up the load on the system as the system was itself extended? Some overflow way of using the excess power available at times is necessary, certain public utilities now being recognized as natural monopolies.

D. B. Rushmore pointed out a feature which is new, but is being more widely recognized. The old plants had a maximum output less than that usually available. Thus it is often impossible to secure contracts when uninterrupted service is demanded. Hence, a steam auxiliary becomes a necessity for the large hydroelectric system. In Los Angeles there is a steam turbine plant floating on the system. In San Francisco there is a gas-engine-driven station. Continuity of service must be guaranteed in some such way.

A. M. Schoen described the conditions existing in one county in the South where there are three systems seeking to dispose of power, but no standardization of these systems has been made. This seems most unfortunate.

Carl Hering outlined a number of applications of electric power, mostly electrochemical or electrometallurgical, which offer opportunities for utilizing excess power available for short periods.

H. N. Muller said that electric power is now being used in Pittsburgh for preparing a special form of steel, though power there is somewhat expensive.

W. L. Waters pointed out the advantages of the induction generator for operating stations in parallel. The objection urged against these has been the necessity of furnishing a wattless magnetizing current from the system, but on such large systems, operating at such high potentials, the charging current of

the line will supply the necessary magnetizing current for the induction generators.

C. F. Scott said that Mr. Lee's paper marked a new stage in the development of hydroelectric systems. In the older systems we have many systems feeding into one point, or one station distributing to various points. But the Southern Power Company's system combines a number of stations using a high-tension distribution system to reach many points. In such systems the problem of the switching and controlling the conversion of a high-tension transmission system into a high-tension distribution system becomes probably the most difficult of all those arising. The hydroelectric development of water powers is one of the most important means of conserving our resources. By combining many systems we save power and get cheaper and more reliable power. Such problems must be studied and developed in a large way. This work requires imagination, initiative and nerve.

E. W. Shedd spoke briefly of the enormous importance of developing the transportation systems of the country. One means of doing this would be to use the excess power not demanded by the mills during the night to haul heavy freight. The light demands of the day passenger traffic would not be felt by the power system. The power companies should be given the right of eminent domain; the public must be educated up to this point. Encouragement of such developments by exempting their bonds from taxation would lead capital into these channels.

President Stillwell pointed out the necessity for attacking the problems of developing hydroelectric systems in the largest way. There are a number of such systems today in financial troubles simply because the engineers had not foreseen difficulties which would have been apparent had there been more time for investigating the conditions. The engineers were in fault for agreeing to make reports on such short notice. He thought the use of the term "engineering" in contrast to "commercial" was unfortunate. The commercial considerations must be studied by the engineers. It would be better to use the term "technical" to differentiate between the physical and the commercial problems. The power companies should have the right of eminent domain, which is now enjoyed by the railways alone. Every reason for granting this right to the latter applies with increased force to the former. We must meet the question of natural monopolies squarely. The states now have the power to regulate the rates of public-service corporations and this fully protects the public as this right will be exercised as soon as the rates imposed become unjust.

Secretary Pope gave some interesting incidents illustrating the difficulty of getting rights of way.

Mr. Lee, in closing the discussion, said that on the system in operation there are differences in head and pondage. The practice is to reduce the head in the ponds as little as possible. This is done by using the steam auxiliary. Voltage regulation is secured by having voltage taps on the transformers, thus giving different ratios for different sections. The problem of sectionalizing the system is difficult. It is impossible to predict the development of power.

THURSDAY AFTERNOON SESSION.

The last meeting for the discussion of papers was called to order at 2:30 p. m. Thursday afternoon, and President Stillwell presented L. C. Nicholson, who read in abstract his paper on "A Practical Method of Protecting Insulations from Lightning and Power Arc Effects."

PRACTICAL METHODS OF PROTECTING INSULATORS.

This paper deals with the experience of four years' operation of the 60,000-volt transmission lines of the Niagara, Lockport and Ontario Power Company, from Niagara Falls to Syracuse and other cities in western New York. These lines were placed in operation in July, 1906, and troubles developed during lightning storms. Switching facilities and general operating conditions have been constantly improved. Since early in 1908, automatic oil circuit-breakers have been used in the duplicate lines at all important stations and paralleling points, making possible automatic sectionalizing of lines and a quick restoration of power in case of an interruption. Analysis of the insulator failures with respect to their location showed a very remarkable result. The number of insulators disabled on the top wire was four times the number disabled on a single side wire, or twice the number disabled on both side wires. This result formed a basis for corrective measures which were taken previous to the lightning season of 1907. These devices consisted of relief gaps installed on insulators at regular intervals on the top wire of both duplicate lines, and the installation of high resistances in the neutral earth connections of star-connected transformers. These gaps were spaced 2,200 feet on approximately 240 miles of line and 4,400 feet on 100 miles, while on sixty miles no gaps were installed. At the time of selecting these spacings there were very little data for guidance. The only definite information available was that during 1906, before the lines were use, insulators were destroyed within a mile of a point where all three conductors were short-circuited and thoroughly grounded. The 2,200-foot and 4,400-foot spacing of the relief gaps on the top wire was adopted in an experimental attitude, the intention being to increase or decrease these distances as future experience dictated. The width of gap first adopted was six inches, corresponding to a discharge voltage of 70,000 volts, depending more or less upon weather conditions. This was also a subject of experiment. The operating results of the lightning season of 1907 showed these relief gaps to be rather an objection than an advantage from a practical operating standpoint. It was early apparent that the gaps perfectly protected the insulators containing them, but that their protective influence was felt only slightly a short distance away on the same conductor, and was not felt at all on the two lower conductors. This was true with gaps set as low as four and one-half inches. Results demonstrated the extreme localization of lightning effects and the difficulty with which the charges travel along a conductor. The net effect of the use of the gaps was to save some insulators on the top wire. The number of line breakdowns was not reduced while voltage disturbances and momentary interruptions were numerous. For these reasons the gaps were removed before the lightning season of 1908. This latter year showed a necessity for making insulations fireproof, and a device for doing this, or rather for making them proof against injury by power arc in the event of a flashover, was developed. This consists of two metal rings concentric with the insulator, the lower one, considerably larger in diameter than any part of the insulator, being supported by grounded metal risers attached to the pin, and the upper one, somewhat larger than the insulator neck and suspended from the transmission cable to which it is electrically connected. An arc between these rings is sufficiently removed from the insulator to prevent overheating the porcelain. On the top wire where most damage by lightning had occurred in the past, and on the lower wires to the extent necessary to accomplish their insulation, a new type of insulator was installed. This is a four-part insulator of about the same diameter as the old-style three-part insulator, but considerably shorter, six inches in fact. It flashes over dry at 190,000 volts, and wet at 105,000 volt. The individual parts and the assembled insulators were tested to dry flashover voltage for three minutes. There was a loss of three per cent of assembled insulators by this test. Various other types of insulators with arcing rings were described, and the results of some experiences and tests given.

F. P. Catchings, opening the discussion, said that continuity of service is the most important problem. His company has installed horn gaps at every insulator. The system operates at 50,000 volts. In two years but two insulators have failed. One of these had its head punctured. The other had been damaged by a rifle shot.

J. W. Fraser said the factor of safety of the insulator is too small. Could not the interruptions be lessened by increasing the insulation? It would cost but from five to seven per cent more on a 100-volt line to double the insulation.

E. E. F. Creighton said that a problem needing co-operative study of all transmission engineers is the causes of spillovers due to lightning discharges in the neighborhood. He suggested the systematic taking of photographs during

storms. An arrester recorder is now available, which shows when discharges take place and their duration.

L. W. Jenks gave a few experiences of the West End Company. They first started out with lightning arresters, keeping complete records of storms and arrester performances. The system consists of 185 miles of line, cut into seventeen sections, each with relief arresters and disconnecting switches. They have brought up the continuity of service up to 99.9996 per cent. This is due to constant inspection and careful watching. They use a factor of safety of four or five for the insulators.

C. F. Scott gave the experiences of a company which was forced to use insulators which had not been thoroughly tested. These insulators began to give trouble and a means of locating the faulty insulators was developed which was described by Mr. Nicholson in a paper presented before the Institute two years ago. Insulator sizes have about reached the limit. The flashover voltage is a serious question, as is also the distribution of potential throughout the insulator. The ring electrode changes this distribution so as to relieve these strains. If we increase the factor of safety the temptation will be to raise the voltage of the line. The United Missouri River Power Company is using a multigap arrester as its standard, and keeps careful records and test papers.

Percy H. Thomas said that the rings solved the difficulty when insulators puncture. When power arcs give trouble, the same remedy is effective. Attacks of lightning are exceedingly local and the stroke may come from one side. Hence two ground wires ought to be better than one, and these should be kept well above the live wires by making the spans tauter. Placing a resistance in the neutral of the raising transformers is a great help. Even though the insulators may be saved, the synchronous apparatus on the system may fall out. Mechanical strengthening of the petticoats would often save the insulators. The disadvantages of a momentary throwing off of the system should not be over-emphasized. He agreed with Mr. Fraser that increasing the factor of safety is the proper way out of the difficulty. The method has removed the old weakness of the transformers.

J. A. Sanford, Jr., said that the engineers are giving more attention to the selection of insulators and he pointed out the fact that where one company uses a four-part insulator another uses one of eight parts.

E. B. Merriam described the peculiarities of the power arc. One of these is its low resistance, which is comparable to a short shunt of copper wire. A large arc may be harmless, while a small arc may be destructive. The important point is the length of time the arc persists.

Three written discussions of the paper had been received, one of which, by Prof. Harris J. Ryan, showed how the presence of the ring about the lower part of an insulator caused a readjustment of the potential strains on the entire insulator. It was suggested that the cable might be protected from burning by a metal stave with a barrier plate at the end.

The other communications were from James Lyman and E. V. Brooks, but due to the lateness of the hour were not read.

Mr. Nicholson, in closing, said there was no appreciable drop of potential of the system when one ring takes a discharge. But if two or more take discharges at the same time the voltage drops out completely. The dangerous range of a direct lightning discharge to earth is at least five hundred feet on each side of the line. The automatic switches will carry a ground for fifteen seconds, but the danger is the development of short circuits which are troublesome to handle. Insulators may be shattered without any puncture any power arcs occurring. Lightning may come in from one side to the line and a trouble at one point set up surges which puncture insulators at a distance. It takes from one-quarter to half a second to destroy an insulator. The aluminum barrier would not be effective and there is no danger to the suspension cables.

D. J. Kerr spoke briefly of the value to the southern members in having a meeting in their section.

C. F. Scott, chairman of the committee on resolutions, spoke of the valuable work of President Stillwell in putting the sections of the Institute on a new basis and congratulated the southern members on the success with which they had carried out the first special convention of the Institute. Mr. Scott then read a cordial resolution of thanks to the citizens and organizations of Charlotte for their hospitality, to the several social clubs for the courtesies extended, to the telegraph and telephone companies, to the many industrial establishments in the city, and especially to the Southern Power Company, and to the local committee.

President Stillwell then declared the Southern Convention of the Institute adjourned.

SOCIAL FEATURES.

On Thursday afternoon a delightful reception was given to the visiting ladies by Mrs. Stuart W. Cramer, and on Friday evening a brilliant reception and dance were given in the Auditorium, when Charlotte society turned out in force to do honor to the city's guests.

Friday was given over to a trip to Great Falls and Rocky Creek stations. A special train of seven cars was provided by the Southern Power Company, which carried a party of 400 to Great Falls. From here they walked to the Rocky Creek station, about two miles south. On the return a barbecue dinner was served at the Rock House, an old stone house built in 1825 by the engineers then constructing a canal along the Catawba River. After the dinner the Great Falls station was inspected. The special train returned to Charlotte at 7 p. m. B.

Society for the Promotion of Engineering Education.

The council of the Society for the Promotion of Engineering Education has selected Madison, Wis., as the meeting place for the annual convention which is to be held on June 23, 24, 25.

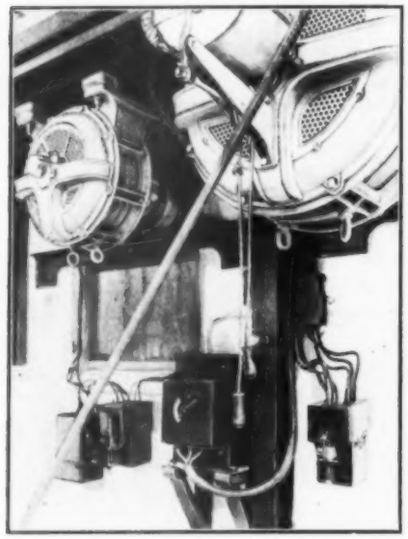
An attractive program has been arranged for the meeting. Possibly the most important items are the reports of the committees on entrance requirements and engineering mathematics. These reports will be presented for final action. Copies of the reports in full will be distributed to the membership some weeks in advance of the meeting. "Technical Education Abroad," "Inspection Trips for Technical Students," "Efficiency in Technical Education," and other topics are already nearly in shape for presentation. Full information regarding the meeting and the general work of the society can be secured from Professor H. H. Norris, Cornell University, Ithaca, N. Y.

Ambassador Irving B. Dudley sends from Rio de Janeiro a copy of the cable concession which has been granted by the Brazilian Government to Richard J. Reidy. This may be consulted at the Bureau of Manufactures, Washington, D. C.

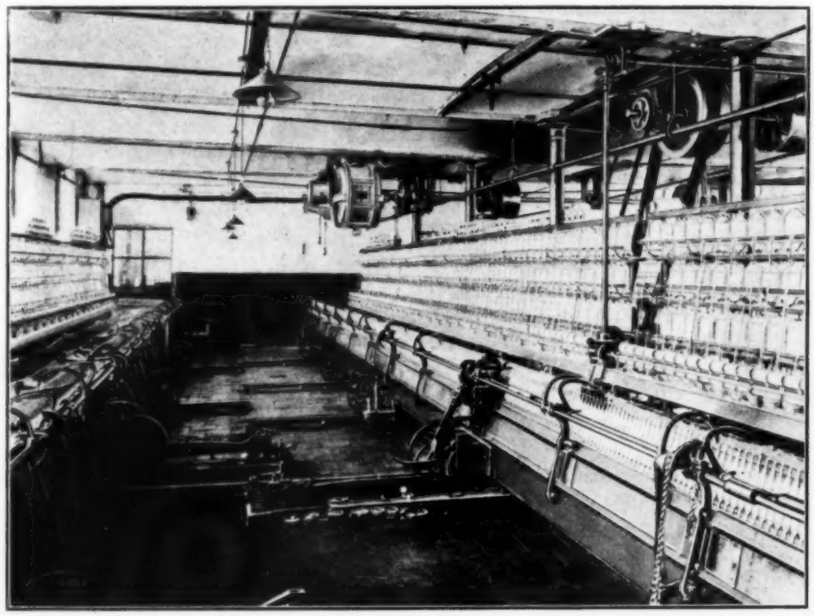
THE ELECTRICAL EQUIPMENT OF A MANCHESTER MILL.

BY OUR BRITISH CORRESPONDENT.

Although the movement in the direction of electric driving of textile works in the United Kingdom has not made that rate of progress that electrical engineers were justified in expecting to result from a fair investigation of the effects obtainable with electrical operation, it is stated that during the past five years—that is, since the setting to work of the Acme Spinning Company's electrically operated mill at Pendlebury—this method of driving has been put into English mills to the extent of over 50,000 horsepower in alternating-current induction motors. A number of important installations, some of them superseding old methods of driving in existing works, and others in completely new mills, are at present in the hands of electrical contractors. Out of the 50,000 horsepower mentioned, it is understood that approximately 20,000 horsepower of the machinery is driven by current supplied from outside sources—either municipal corporation electricity works or the Lancashire, Yorkshire and other big electric power companies. One of the latest examples of electrification in this class is found in the installation that has been set working at Manchester for the Bannerman Mills Company, Limited. This is known as the Brunswick mill, and it is one of a very old established concern. For many years it has been run in the ordinary way, having been driven from steam engines and the power transmitted to the various mill rooms by means of belt, rope and gear drives. For several generations the mill has been continuously and successfully driven in this manner, and it required on the part of the mill authorities, considerable confidence in the reliability and commercial economy of electrical transmission to depart from their time honored method of driving. After exhaustive investigation of the various questions involved, C. W. Macara, the managing director of the Bannerman company, decided to place the continuity of the running of the Brunswick mill in the hands of an outside source of power, namely, the City Electricity Department of Manchester, which is, as is well known, meeting the electrical power needs of many other large and important industrial works in its district. The installation at the Brunswick mill is one of the largest single mill equipments at present working electrically in the United Kingdom. It has been carried out by the British Thomston-Houston Company, Limited, of Rugby, to whom the writer is indebted for the accompanying photographs of the various features of the installation, and it has been generally supervised by S. L. Pearce, the city electrical engineer of Manchester.



MOTORS IN TOWER, DRIVING LINE SHAFTING—BRUNSWICK MILL.



WING MULE ROOM IN BRUNSWICK MILL, MANCHESTER, ENGLAND, SHOWING ELECTRIC DRIVE.

The mill contains both mule and ring spinning spindles and on the federation basis is rated as equal to 100,000 mile spindles, spinning from 36's to 72's counts from American and Egyptian cotton. The whole of this machinery was originally driven by means of two steam engines—a two-crank beam engine and a single crank horizontal engine with a combined power of 1,600 indicated horsepower. For transmitting the power from these engines to the various rooms in the mill, spur and bevel gears and upright shafts from the large beam engine were adopted, and rope driving with bevel gears from the small horizontal engine. By adopting the electrical drive, practically all of these gears and upright shafts were dispensed with, and today there remains in the mill only two small pairs of bevel gears, one at the foot and the other at the top of an upright shaft, which, for purely local reasons have been allowed to remain for driving a small amount of light machinery in the east wing of the mill.

The mill is now driven throughout from the mains of the Manchester Corporation, by means of three-phase induction motors, working on a 400/415-volt supply at a frequency of fifty cycles per second. The current for driving the mill is supplied from the corporation mains at 6,500 volts, a duplicate set of mains being carried to a substation arranged in the basement of the original small engine house. It is there transformed from 6,500 volts to a working pressure of 400/415 volts

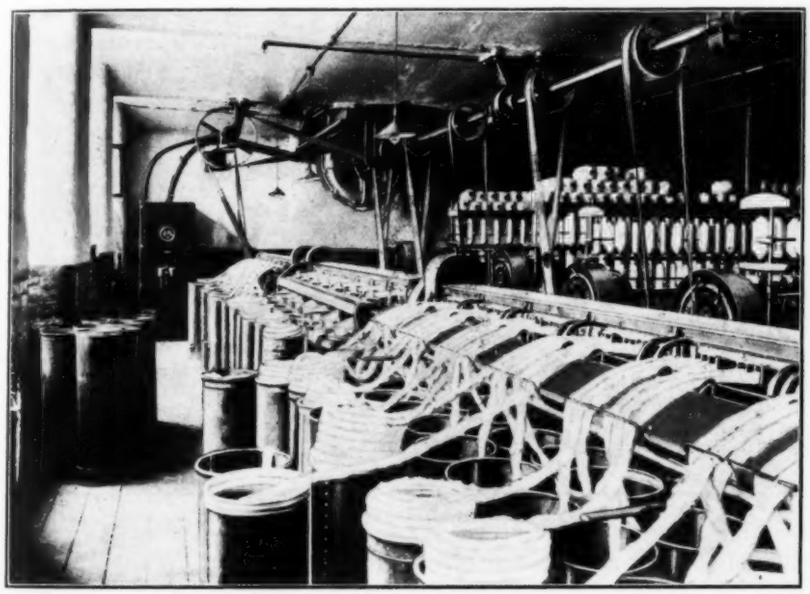
for the motors, and to 220 volts for lighting purposes. The mill contains in all thirty-seven motors aggregating 1,640 brake horsepower.

In describing the methods adopted for driving we may commence at the point at which the raw cotton is received in the mill and follow it through the various manufacturing processes until it is ready for despatch as the finished product.

The bale hoist is situated in the west wing, and for driving this hoist a small motor is installed inverted on the ceiling of the blowing room and driving by belt on to the hoist shaft. There is therefore no current consumption at this point, except at those times when the hoist is actually working.

For driving the bale breaking, mixing lattices, and blowing-room machinery a special motor of forty-five horsepower is installed in the blowing room and directly connected by flexible coupling to the line shaft, from which the blowing-room machinery is driven. This line shaft now runs at 480 revolutions a minute, having been speeded up from its original speed and the line-shaft pulleys altered accordingly. The line shaft driving the bale breaking and mixing room is driven from this shaft by belt. The motor is of the slip-ring type, and is started by means of a triple-pole automatic-trip oil switch and a totally inclosed metallic starting rheostat mounted on a panel erected close to the motor.

The main card room, which is situated on the second floor of the main mill, and containing 112 cards and sixteen preparation frames, is driven by a 150-horsepower slip-ring motor, directly connected to the main card line shaft, which is running at 290 revolutions a minute, a flexible coupling being installed between the motor and the line shaft. In this room there were originally three main lines of shafting. By the installation of electrical driving one of these lines was dispensed with, and two rows of cards driven from one shaft placed between the two rows, the remaining line shaft being driven from this by ropes. The starting apparatus for this motor is a triple-pole automatic-trip oil switch, and totally inclosed metallic starting rheostat mounted on a suitable panel.

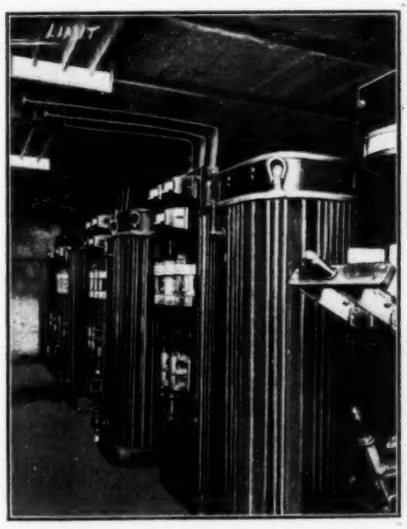


VIEW OF THE FRAME ROOM, BRUNSWICK MILL, MANCHESTER, ENGLAND, SHOWING MOTOR DRIVE AND SWITCHGEAR.

The speed frame room, containing sixty-four drawing, slubbing, intermediate and roving frames, is situated on the third floor of the main mill. This room is driven by means of a 130-horsepower slip-ring motor, directly connected to the main line shaft by a flexible coupling, running at 485 revolutions a minute, the installation being generally similar to that in the card room mentioned previously. In both these cases, since the rooms driven contain preparation machinery, and the atmosphere is often charged with cotton dust, it has been found advisable to cover in each of the motors with a sheet-iron case connected by shallow air trunks with the outside atmosphere, a small electrically-driven fan being installed for drawing air from the outside of the mill on the one side through the motor and out again to the other side of the mill. This provides adequate ventilation.

Two small roving rooms, one in each of the two wings, are each driven by one eighteen-horsepower squirrel-cage motor, directly connected by a flexible coupling to the line shaft running at 475 revolutions per minute; each of these motors is started by an oil immersed star delta starting switch, situated close to the motor.

The ground floor, and the fourth, fifth, sixth and seventh floors in the main mill, each containing four pairs of mules and ten ring frames, presented one of the most difficult problems for solution, and the method adopted for driving these rooms is undoubtedly one of the most interesting features in the entire installation. The positions of the machines in the various flats rendered it practically impossible to group more than two pairs of mules on each motor. This in itself was a somewhat difficult requirement, inasmuch as the power demand for driving this particular class of machine varies to a considerable degree, the maximum demand being at the very least twice the maximum and the cycle of operations being comparatively rapid. A further serious consideration affecting the method of procedure to be adopted was the necessity for such an arrangement as would enable the mill to continue its ordinary working during the change-over. The method adopted, therefore, to drive these flats was to



TRANSFORMERS AND SWITCHGEAR, BRUNSWICK MILL SUBSTATION.

build two motor towers, one at each end of the mill on that side of the mill nearest the courtyard. The towers, which are independent of the main mill structure, are built entirely of steel framing and glazed casing, no brickwork being used. In each of these towers two motors per floor are installed for driving each spinning room, there being in all ten motors per tower. Each of the motors for driving the mules is of the slip-ring type rated at seventy-five horsepower, running at 485 revolutions per minute, and coupled directly to the main line shaft by means of a flexible coupling. Each of these line shafts runs the full width of the mill and drives by belt the four countershafts for the mules, special pulleys being provided on the line shafts to suit the increased speed.

The ten ring frames which are situated in the two lines along the middle of each spinning room are divided into groups of four and six, and, owing to the fact that it was necessary to provide that the mill authorities could conveniently alter the speed of these frames to suit the various counts to be produced, a novel and ingenious system of rope transmission, which provides for three changes of speed at the spinning frame, was adopted.

The six frames on each floor at the western end of the mill are driven from a line shaft carried half-way across the room and running at 725 revolutions per minute (probably the fastest running line shafts in the world driving ring-spinning frames), a squirrel-cage motor of forty-five horsepower being directly coupled to the line shaft by means of a flexible coupling. Rope pulleys of special design to provide the three changes of speed required are installed on the line shaft, the frames being driven by ropes over adjustable gallows pulleys.

The four ring frames on each floor at the eastern end of the mill are driven in a similar manner from a line shaft, running at 725 revolutions per minute, directly coupled to a thirty-horsepower squirrel-cage motor, there being in all five floors so driven.

The starting apparatus for each of the motors in the two towers is arranged in the towers on the same floor as the motor, and a special arrangement of emergency push buttons is fitted in each room, so that in case of necessity any motor may be stopped from the inside of the mill.

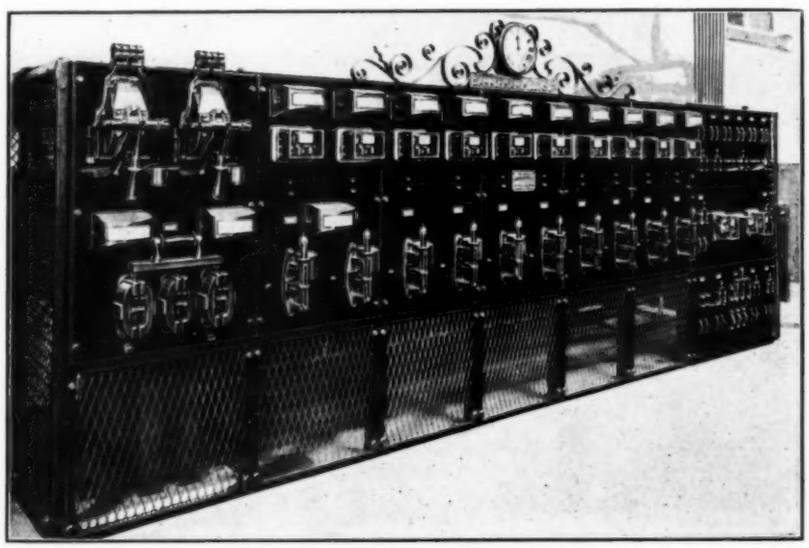
The winding and beaming machines situated on various floors of the east wing are driven by means of an eighteen horsepower motor, 475 revolutions per minute, squirrel-cage type, driving by belt on to a line shaft, the power being transmitted to the various floors by means of a light upright shaft and two pairs of beveled gears.

The mill hoists throughout the mill are each driven by separate motors, as also is the mechanics' shop.

Advantage has been taken of the alterations carried out to equip the mill throughout with sprinkler apparatus, the sprinkler tank being arranged on the top of the eastern motor tower. The supply of water to this tank is by means of an electrically-driven high-lift turbine pump, provided with special starting apparatus, which automatically starts up the motor, in order to keep the tank filled, when any of the sprinklers in the mill are in operation. The pump continues to run and supply water until it is shut off by hand.

A further special feature of the installation is the main mill switchboard, providing current for the various motors. This board is arranged on the first floor of the original small engine house, being therefore situated directly over the corporation substation. There are in all ten main motor feeder circuits on this board and one incoming feeder circuit; also one main lighting board. Each of the motor feeder circuits is fitted with a triple-pole oil switch having automatic overload cutouts, and further, each circuit has polyphase indicating wattmeter and polyphase integrating wattmeter installed. These instruments enable the mill authorities to read at any moment the exact amount of power being consumed on each circuit, and also to "log" periodically the amount consumed during any period. The information obtained in this manner by the mill authorities has proved of distinct service to them, forming, as it does, a complete check on the operation of each department.

The distributing mains and branch cables between the mill switchboard and the various motors are of the three-score steel-tape-armored type throughout, and are carried along and fixed to the mill walls and ceilings. Where more than one motor is fed from the same circuit, inclosed distributing fuse boxes are installed, each of the three phases being in a separate box. The whole of the distributing boxes for the main mill motors are erected on a steel framework on the first floor level of the western motor tower, from which separate cables are run to each motor. The distributing boxes for the two wings of the mill are erected on the landings by the staircases.



THE MAIN SWITCHBOARD, BRUNSWICK MILL.

The mill is lighted by about 1,000 carbon-filament, 220-volt lamps, a separate three-phase lighting transformer being installed to provide this lighting current, and the mill circuits being arranged so as to preserve the balance of load between phases. The wiring is carried in heavy-gauge steel-screwed tubing, fixed to the mill walls and ceilings, the whole in strict accordance with insurance requirements.

MINNESOTA ELECTRICAL ASSOCIATION.

THIRD ANNUAL CONVENTION IN MINNEAPOLIS, MINN., MARCH 29-31.

The third annual convention of the Minnesota Electrical Association, held in Minneapolis, Minn., March 29, 30 and 31, marks a new era in the life of that organization, as the attendance surpassed that of any previous meeting and the programme carried out was a credit to the executive committee. Headquarters were established at the National Guard Armory and the Electric Show held in the same building during the week of the convention afforded the delegates an opportunity of viewing the latest advances in the electrical industry.

The meeting was called to order by President H. J. Gille promptly at 10 a. m., Tuesday, March 29, and, after a few words of welcome, the reports of the outstanding committees called for. These reports indicated progress in the various branches investigated and after brief remarks they were all accepted by the Association. The President's address was next in order, an abstract of which follows.

The past year has been one of great prosperity in this country, but especially so in Minnesota. The electrical industry is naturally dependent upon the general prosperity of the community, although probably not to as great an extent as heretofore, for the reason that electric lighting has changed from a luxury to a necessity. In spite of the advances that have been made there is still great opportunity for improvement and expansion. A brilliantly illuminated store presents a cheerful and inviting appearance, which merchants have come to realize is a very important element to success in business. A well designed and decorated show window is generally regarded as one of the best means of advertising. The advent of the tungsten sign lamp has made a great change in the efficiency of these units. Therefore, with the large variety of signs and window lighting devices in use and being placed on the market, these classes offer great opportunity of improvement. Regarding street lighting, a well lighted city is a well advertised city. Many cities have installed uniform ornamental systems of street lighting which are benefiting both the public and central stations, and central stations contemplating installations can obtain information from these towns. There are many questions constantly arising in the development of electrical properties that affect future earning capacities as the importance of the service becomes greater. More money is constantly required to make extensions to systems and to increase station capacity, which requires comprehensive planning for construction, so that investments made in extension and improvements will be of a permanent and efficient character. The proper arrangement of buildings, installation and kind of machinery to provide for increases have often been overlooked, stations being planned only to take care of a certain definite load. One of the most important features in developing properties is good service. This includes not only continuous service but also taking care of the wants of the customers and seeing that the men who perform general service are prompt and courteous in their attention. The value and importance of the proper management and policies of the commercial and advertising end of central-station work was also fully discussed in this address. In regard to an electrical building to be constructed at the Minnesota State Fair Grounds, President Gille strongly urged the association to formulate plans, immediately, for the bringing of this subect before the board of managers of the State Fair. The question of water power development was taken up and it was urged that facts in connection with this be kept constantly before the association.

The first paper presented at the afternoon session was one entitled "Developing Business," by Robert W. Clark, of the Minneapolis General Electric Company. An abstract of this paper is presented herewith:

In a review and analysis of the underlying causes for the rapid development and enormous growth of the central-station industry in the past decade, it requires on the part of those who have kept in close touch with electrical matters only a casual summing up of observations to reach the conclusion that of the several main factors responsible for the rapid strides made in the business, none have been of greater importance than that of specialized effort in the direction of developing business. In spite of the allowances being made in the electrical industry, unless full advantage is taken of each advance made in satisfactory business producing methods and the same are applied to the respective communities at the right time, there will be a constantly widening difference in gross earnings per capita between companies that do and do not take advantage of these conditions. If the trouble were taken to investigate and analyze individually the exact origin of the desire that resulted in the influencing of 100 consumers to use electric service, in any community, the results given would prove inestimable in the way of increasing the efficiency of efforts to secure new business. The pivotal point upon which the major portion of the whole question of business development rests is the ability to let the people know, or to create the desire. The most valuable requisite in the make-up of those engaged in the commercial development of central stations is a thorough practical and intimate knowledge of the possibilities of electric service. In considering the immediate possibilities of central-station business there is nothing more susceptible to a large development as residence lighting. This class of business should be gone after now, as there is a wave of popular approval sweeping the country in favor of the use of electric service in the home. This has been given a great impetus by the introduction of high efficiency lamps and much credit is due the manufacturers for the development of these units and the broad-gauged policy pursued in educating the public as to the economies to be derived from their use. Much time and money has been spent in the past in an endeavor to clip a small percentage from the cost of manufacturing and delivering a kilowatt-hour, while, after the product is turned over to the customer, a waste has been permitted to go on which has affected the cost of service to the consumer in an amount equal to many times anything saved in manufacturing costs. Economics of operation are to be commended, but the time has passed where it was simply a question of "pumping" a set of service wires to the consumer's premises and "dumping" a few kilowatts there each month. The time has come when it is incumbent for central stations to interest themselves in the manner and method of using electricity on the customer's premises, so that the greater possible economics and benefits may be secured from the use of electric service. Many of the economies can only be effected by an extra investment in wiring and switches, but the public must be convinced that it is an investment and not an expense and that it does not take long for the saving in running cost to wipe out the principal. The liberal and proper use of switches in residences makes possible not only variable intensities of illumination, but distant and adjacent control that insures, in addition to safety and comfort, a progressive illumination in the way of brightness ahead and darkness behind that makes for the greatest possible economy. Liberal switching arrangements in residence wiring, while it makes for lower revenue per consumer, it reduces the cost to serve, from the fact that intermittency of use by a number of consumers of this kind, materially improves the diversity factor of their demand on the plant, while the same is true of its effect on the localized transformer capacity and distribution system. In the lighting field there is room for much work in developing window and sign lighting. The tungsten lamp, which for window lighting makes it easily possible to double the illuminating intensity over former practice at about the same cost of service is something which was badly needed in order to enable electric service to fulfill its true function in this direction. As to sign and decorative display lighting, the tungsten sign lamp has put that business in a class by itself. It should be borne in mind, however, that in this as well as in window lighting an effort should be made to keep the character as well as standard of these displays as high as possible. High grade ornamental street lighting rightfully belongs in the same class and entitled to fully as much attention in bringing about its development. It is, perhaps, the most important in the way of popularizing the use of electricity, as it usually is the result of a co-operative movement on the part of merchants and public-spirited citizens. All companies should adopt a liberal policy in regard to the extension of lines and equipment as availability of service in a community is a large factor in influencing the development of the business, as the residents of any given locality where such is the case are much more liable to become interested in the possible use of the many useful economical electrical devices which are constantly being placed upon the market. The use of these devices is becoming more and more extended as time goes on and it is safe to say that in progressive communities where liberal and progressive policies are pursued by the central-station companies, the point of saturation in business development will not be found short of $20 per capita at the end of five years.

Following the reading of Mr. Clark's paper a brief discussion ensued relative to the last statement made in the paper, namely that the point of saturation in business development would reach $20 per capita. Messrs. Hildabrand, Gille, Kemper and Cravath spoke of their contentions along this line which pointed out that average gross revenue of central stations is betwen $4 and $5. Mr. Clark substantiated his statement by itemizing the revenue per capita of each class of service.

At the close of this discussion a paper

entitled "Street Lighting for Small Cities" by J. R. Cravath was presented. The following is an abstract.

The street lighting problem in small towns differs radically from that in large cities, for the reason that the revenue available per block of street in large cities is usually much greater than in the small towns. As a general proposition in the past, in cities west of the Ohio Valley, it may be safely said that street lighting appropriations have usually been insufficient to provide the equivalent of one arc lamp for every street intersection. In large cities on the other hand, an arc lamp to every street intersection, or even at more frequent intervals is common. Attention need hardly be called to the great improvements which have been made in our street illuminants the past three years. The tungsten series street lamp, even without reflector gives about three to four times the illumination which was commonly obtained formerly from the old fashioned series carbon filament incandescent street lamps and is also more efficient than the common enclosed carbon arc. With the scientifically designed reflectors, which have come into use along with the series tungsten street lamp, more light useful for street lighting is obtained from the tungsten lamp of a given candle-power than could be obtained from the old carbon filament lamps with the reflectors or hoods which were formerly common with such lamps. The reflector used with the series tungsten street lamp common at present, adds roughly about twenty-five per cent to the useful candle power of the lamp. In ordinary calculations the writer has been accustomed to figure that dirt and depreciation will reduce the candle-power of an incandescent tungsten lamp used for street lighting about twenty-five per cent. In other words, it will just about counterbalance the increase in candle-power caused by the use of a modern reflector. We may, therefore, consider the candle-power of a series tungsten lamp for street lighting purposes as being equivalent to its mean horizontal candle-power. In arc lighting for street purposes there has also been a great improvement in three years. For example, a 6.6 ampere old style alternating-current enclosed carbon arc lamp in practical commercial work will give as shown by test conducted for the National Electric Light Association, something less than 200 candlepower at the angle most effective for street lighting. A 6.6 magnetic arc lamp taking about the same number of watts, probably gives at least six times the candle-power in the direction most useful for street lighting, although the particular test mentioned before was not carried out on the 6.6 ampere lamp. The four-ampere magnetite lamp is not so efficient. We have also the new titamum carbide arc for alternating-current circuits. The situation in a nut shell in the average small town is this: The city has not the money to pay for an arc lamp of any kind on every street corner. It probably does have the revenue sufficient to pay for some kind of a series tungsten lamp on every corner. As a rough example, suppose that the city is now paying for carbon arc lamp on every other corner at the rate of $70 per year per lamp. The substitution of double the number of 100 watt tungsten series lamps at $35 per lamp so as to provide one of these tungsten lamps on every corner, cannot fail to produce a street illumination so much more satisfactory than the old system of an arc on every other corner. At this point some central station manager who is familiar with his operating cost will inquire what advantage it may be to the central station company to obtain a contract for street lighting which involves considerable expense for reconstructing the street lighting system as far as the lamps and their support are concerned; when there is to be no increase in gross revenue. They will argue and rightly that the substitution of two 100-watt lamps for each 400-watt arc lamp will not make a fifty per cent reduction in the central station operating cost for its street circuit. The only reduction in operating cost which would be effected by the change would be a very small reduction in fuel bill. In fact the fuel reduction in many cases would be so small as to be undiscernable. These arguments are perfectly sound. What inducement, therefore, can be offered to the central station company to change its street lighting system, even if it can obtain as high a rate as $35 per annum per 100-watt tungsten series lamp? The answer to this question depends much upon local conditions. However, in the majority of towns there is a growth of population and a demand for an increasing number of street lamps. There is also an increasing demand for electricity from private consumers. If the demand on the station can be reduced by the introduction of the improved street lighting system, the station capacity so released during the peak load hours can be sold to private consumers.

R. W. Clark opened the discussion of this paper and agreed with Mr. Cravath that tungsten lamps on every corner in a town was much superior than an arc lamp on every other corner.

William Kemper said that he agreed with Mr. Cravath regarding the use of tungsten lamps and added that an ornamental system of street illumination was the most beneficial to the central station as it invariably resulted in extensive window and sign lighting on the streets where such installations are made.

Messrs. Gordon and Strong spoke favorably of ornamental street lighting, also, and cited their experiences in this connection.

"Accounting" was the title of the next paper, presented by Thomas Pitts.

The two essential requisites of an accurate system of bookkeeping consists of the faithful and unvarying recording of every transaction, and a keen distinction between the items of expense, maintenance and investment. If these essentials are maintained the system may be said to be accurate, and if same is judiciously classified for convenient monthly and yearly consultation and comparison, then if the plant is not saddled with an investment unwarranted by the volume of business to be expected, there should result a balance on the right side of the profit and loss account. The ledger accounts may be arranged to show whatever it is most desirable that they should show. What the owners or stockholders always wish to know, is how much each branch of the plant has cost, or in other words how the money invested has been expended, how much has been expended in the upkeep of same, the income from the several sources, and the expenses incurred by the various departments, leading up to the profits and the declaration of dividends. The yearly income of a central station may be considered as uniform, it should grow, we cannot think of it diminishing but it does not fluctuate. Similarly, except for casualties or the unforseen action of the elements expenses are uniform. At first this may not be so apparent as in the case of income, but the fact obtrudes itself upon closer consideration that the expenses of upkeep and maintenance, while possibly not due at the time present is accuring just the same as the interest on any obligation we may have, and should be accounted for (preferably by a monthly or yearly book entry) or in the event this is not considered necessary, at the time of dividend declaration. In the matter of casualties and the unforeseen, if it is not deemed advisable to provide a fund for this purpose, when such does occur the expenses should be distributed over such term of years as may be deemed necessary to properly apportion the same. With income and expenses that do not fluctuate, dividends should not fluctuate, they should grow with natural growth of the business, they should not diminish. Dividends are not always, but they should be an indication of the prosperity of a business. Sometimes they are declared on the principal of dividing up a pot of money, simply because the funds happen to be on hand, which funds should be set aside or used for other purposes, and vice versa a plant may be making fairly good returns and still be unable to declare a cash dividend, unless stock or bonds are issued or loans made to take care of the additional investment to which the profits have been applied. Bearing in mind that with these small plants as little time as is consistent with the requirements and the desired results, can be devoted to the accounting department, it is essential that the number of Ledger accounts be made as small as possible, a large number of accounts being an additional liability to error, and entailing additional labor in the preparation of the monthly trial balance and balance sheet, and as it is in the expense accounts that the greatest amount of sub-division is desirable; the number of these accounts may be kept down by the itemization in the ledger of each entry under these accounts. Mr. Pitts then described the system in use by his company.

The discussion which followed the reading of this paper was very brief, Messrs. Hildebrand, Gordon and Clark asking Mr. Pitts about details of the system he described.

President Gille asked how the system as outlined compared with the rules of public service commissions. Mr. Pitts said that many of the accounts described were identical with those advocated by the commissions.

The next paper presented was one on "Gas Engines," by Alfred Horne. This paper, an abstract of which is given below, described in detail an actual installation of gas engines as prime movers.

Our plant consists of two 160-horsepower producers, one 80-horsepower single engine and one 160-horsepower twin engine, and a wet and dry scrubber. The plant is of the suction type, built by the Minneapolis Steel & Machinery Company. On October 23, 1907, we started up the first unit, which was the eighty-horsepower engine, and November 28 of the same year we started the 160-horsepower engine. We had some rather strenuous experiences for a few months after we got started up; there seemed to be more trouble than anything else connected with the equipment, and for some time I was quite discouraged. There was a man from the factory with us for six or eight weeks, and we would have trouble every two or three days, and sometimes two or three times a day. I would, of course,

try to learn what the trouble was from the erecting engineer and there always seemed to be something different, only it would generally act the same way; kill the speed of the engine or, in a great many cases, close us down entirely. Finally we began to be able to locate some of the troubles. We learned that we could not operate if our producer was clinkered up. It was one continuous round of trouble if they were clinkered; in fact it seemed hard to get the engine started in a great many cases; the gas seemed to be so poor that it would not ignite, and then if we did get the clinkers out and put in a large amount of fresh coal it seemed to make the gas so rich that it would also cause us trouble. It would seem to one at first thought that the clinkers should be poked down quite often, but it only packs the ash and clinkers so hard in the bottom that it is almost impossible to get them out. We do not poke our fires one-quarter as much as we used to. We have now been operating on one producer for two years continuously twenty-four hours a day and it is in just as good shape as the day we started it. We did start up the second producer this past winter to see what the action would be on the engines and to see how much more fuel it would take. We found that it took about two hundred pounds more coal to operate the two producers than it did with one. However, the engines worked better under heavy load on two producers than on one. This would rather indicate to me that they over-rate the producers for the best service. The gas engine has had a hard fight on account of the high first cost; modern and economical steam apparatus and troubles that have been experienced with the engine in its early developments caused by inexperience. In a great many instances I understand the trouble was due to the fact that the producers were too small. And a great deal has come about through poor coal. They have in several sections of the country tried to use a semi hard coal in which there was a great deal of tar and mineral matter, which made it very backward and discouraging. However, today the gas engine builders and operators know more about those things and are able to eliminate a great deal of this trouble. We try to be quite careful in the selection of our coal, but even then there will now and then a bad car slide in. If we get a dusty car of coal we screen the coal before we use it, and I think it would be well to screen all the coal before it gets to the bin. This can very easily be done. The gas engine is steadily finding its way into the field on account of its economy, which in the near future is going to mean a great deal. With all the new and modern electrical appliances that are now coming into the market it is soon going to call upon your plants for a large output of current, when a little saving in coal will mean dollars at the end of the year, to swell the purse of the stockholders of your company.

President Gille opened the discussion of this paper, asking Mr. Horne how the cost of labor for the operation of a gas engine plant compares with the cost of labor in a steam plant. Mr. Horne compared the number of employees necessary in a gas plant with those necessary in steam plant of corresponding size which showed the help required to be about equal.

Mr. Street asked if the $400 expenses was not a low figure as compared with repairs in a steam plant.

Mr. Horne, replying to this, said that the expenditure of $400 included a stock of parts and repairs which, according to past experience would last some time longer, thus lowering this figure next year.

Mr. Wagner told of his experiences with gas engines and said that a good foundation was an important point in such installations. He cited a particular example in his own experience.

WEDNESDAY SESSION.

The meeting was called to order at 9:30 a. m. Wednesday and President Gille called upon S. E. Doane, chief engineer, National Electric Lamp Association, to address the Asociation on the "Trend of the Times."

Your president has asked me to talk to you this morning on "The Trend of the Times." My talk will not be exactly along the lines of the subject treated in a paper which I prepared, consequently I will have to speak to you without considering all of the phases of the trend. A year ago when I talked at the American Institute meeting in Minneapolis I thought the year which had closed could not be excelled in interest; I thought it was the most interesting year since the development of the art. I can say the same thing again; it has been probably the most interesting year the industry has ever seen, and the industry is beginning to assume more definite plans toward this high efficiency lamp. In the high efficiency lamp the most interesting development of the year has been the fact of the manufacturers of the world coming together in technical development. When the tungsten lamp first came out in Germany, of course, the American manufacturers all went abroad to purchase the foreign rights. It developed the fact that there are only about thirty men in the whole world who are mentally equipped and competent by training to do high class research work. Carbon lamp development worked altogether in a different way. Carbon is a curious chemical compound. It is extremely difficult to accomplish anything unless one has a foundation upon which to build, whether it is the building of a house or whatever it may be, you must have a firm foundation upon which to build. Carbon is such a curious thing chemically that we do not know whether we ever saw real carbon chemically. It is hard to get a grasp of the situation. We know the carbon lamp is the result of working with a definite element, but the tungsten lamp is the work of physical research. All carbon is worked at a high temperature, and the film manufacturer had to blaze the way. As stated at the beginning of my talk, the manufacturers of the world have now come together, and we exchange among ourselves the results of our investigation and research work. The result is that among these thirty men there are perhaps only a half-dozen men in the United States directing research work, and they have probably a hundred men assisting them. Abroad they have more men of that character, but they have less money to work with. I do not think any art in the history of the world has developed like this, where the whole research ability has been spread among different problems so that the various men need not duplicate one another's work. That insures the progress of the high efficiency lamp which is almost as sure as the rising of the sun. I know lamps can be built for much higher efficiency than now. We have heard of a few lamps with .75 as against 1.5 watts, and the fact that a few lamps have done that means that when we have mastered our chemical problem we shall have our wattages reduced considerably. I think a .5 watt is reasonable to say will come, it may not be next year and it may not be the year after, but it is certainly coming. The trend of the times has developed another curious situation, and that is that the central stations as a class have not attempted to push the tungsten lamps. I do not know of a single case among the 6,000 stations where they have consistently taken the carbon lamps out and put in tungsten. Some have adopted the tungsten policy to see what would come of it, and the unmistakable trend of the times has been toward a lower voltage lamp. Abroad they have developed a twenty-watt lamp; they have produced a twenty-watt lamp. The filament of that lamp is twenty one-thousandths of an inch in diameter, and it is worked with a magifying glass. The times have developed a demand for a low wattage lamp, and we have to produce a lamp that is practical and also a low voltage lamp. One lamp I have in mind at Hartford, Connecticut, where they use a sixty-volt and twelve-watt lamp as a standard. They also have produced a cheaper filament. A sixty-foot filament is cheaper to make than a 100 foot filament. The greatest development has been in the high wattage lamps, 500 to 1,000, and while such lamps have been built upon order and while we have had some commercially installed, we feel we cannot say they are successful. It may be satisfactory, we have not had time to find out. It takes a great many days to find out even with a twenty-four hour day. I think, perhaps, the most interesting work which the lamp manufacturer has done this year has been to determine just why the central station has not been adopting the tungsten lamp. I was talking with one of the largest central station men last week, and he said he had framed a definite policy for his community, and that is to put in the tungsten as fast as his business increased. He could not consider the displacing of the carbon lamps and putting in the tungsten. When we consider that the tungsten is the most remarkable development in the history of the art, it is hard to realize why the central station should take this attitude. If a man snould came to you and say he would build a boiler, or could do something of that sort, whereby you could get a pound of steam from three pounds of coal, you would immediately consider ways and means as to how you could install that boiler. The question of whether or not you wanted it would not enter into consideration, but it would be a question of what it would cost you, and you would throw away the old equipment and put in the new. The lamp manufacturer comes along and does just that same thing. He gives you twice the light from the same energy, from the same investment, the same service wire, you do not have to scrap a single thing to get it, the sockets remain and the new lamps are screwed on in place of the old, and everything is just the same except the lamps. When one considers the enormous possibility in such an innovation, the enormous saving, one's first thought is that the central station would be glad to carry the new lamp. We see the trouble in the situation is based on the tremendous advantage which comes to the customer's side of the meter, and we all know the reduction in cost to the consumer is very much greater than the reduction in cost to the central station. I hear it all over this country that the central station man is awake to the situation; he is awake to the fact that seventy per cent of his income in general figures comes from lighting. Statistics show there are from a million to five hundred million dollars invested in central station equipment, and that is really only about four per cent, so it is quite obvious the central station can stand a little reduction in income, and it is quite sure he can stand the reduc-

tion if there is no cost to himself. Note that we have the economic situation where, if it were possible to immediately add twice as many customers to our mains as we have at present, it would probably be possible to cut the cost to the consumer in half and increase the profits to ourselves. The problem is a serious one; it is one which is being given a great deal of thoughtful attention, and I think you will concede it is the most remarkable development of the trend of the times during the past year.

A brief discussion followed this talk, in which Messrs. Gille, Clark, Kemper, Pitts, Glass and Shepardson took part. In answer to a question regarding rates, Mr. Doane said that this was a subject which he wanted to particularly avoid.

Following this discussion a paper was presented by Harry G. Glass, of the Westinghouse Electric and Manufacturing Company, on central station motor applications which described a number of interesting applications. An abstract of this paper is presented herewith.

A printing plant in Youngstown, O., handling a daily newspaper with one afternoon edition of 15,000 to 20,000 copies, a considerable amount of job printing, but practically no catalogue or book work requiring fine printing, was to be changed from gas engine drive to individual motor drive. A great deal of trouble had been experienced on the newspaper press from uneven speed, which caused the paper to be torn frequently. As each tear required stopping the press and feeding the paper into the cylinder again, it came to be a somewhat serious delay when it occurred several times an hour as it often did. To provide for different speeds on the job and straight line presses it was decided to use direct current and install a five-kilowatt motor-generator set supplying power at 110 volts. The four job presses were each driven by a one-quarter-horse power, shunt wound motor, belted to the large flywheel, the Miehle press was belt driven by a two-horse power, shunt wound motor, and the Babcock press by a three-horse power shunt wound motor, belted to the counter shaft of the press. These motors were fitted with armature resistance control by the use of speed regulating rheostats. The outfit consisting of both direct and alternating current apparatus provides a simple equipment for all the larger machines and introduces the losses in a motor generator set of but a small proportion of the total installation and yet obtains all the advantages of direct current operation. A gas engine factory in Oil City, Pa., in the natural gas territory, where are manufactured gas engines for oil wells and where the load used in testing the completed engines is obtained by driving the factory shop equipment itself, inquired regarding electric drive. A representative looked the conditions over and found that the power was actually costing almost nothing, as the load for testing the engines must be obtained from some source and would be but wasted if electrical power were used to drive the factory. He recommended that the gas engine power be continued, but the owners, who were interested in a woodworking plant recently equipped with individual motors, insisted on purchasing electric power and a complete equipment was sold. There were no new features of the drive, although it was entirely individual, so no description is given, but it is significant when a manufacturer of gas engines, who is really obtaining his power for manufacturing without cost, decides that the convenience and reliability of purchased electric power warrants its use in his own factory in preference to the power in his own line of business. Another instance of the use of central station power is quoted without details of the installation itself from Ashville, N. C. The original installation consisted of steam engine-driven wood working machinery from which a large amount of refuse was produced. All refuse consisting entirely of chestnut was burned under the boilers, and our representative was thought to be joking when he first proposed that it be sold, for there was supposed to be no possibility of a market in this region. But on investigation our representative found a tannery about five miles distant where arrangements were made to sell the off-fall at $2.50 a ton, the tannery having previously bought material which cost them $4.00 per ton. The installation went in and the sale of the refuse made a substantial profit over and above the cost of the power. Thus purchased electric power saved money for two concerns, the one that installed the motors and the tannery. A planing mill doing jobbing work of a general character, mainly on soft wood, pine, etc., interior work, driven by a single steam engine with line and jack shafts, decided on individual drive. This installation complete has 231 horsepower connected motor capacity, a total of thirty-one motors, and employs seven to ten machine operators and four to five bench men. The old boilers have not been replaced but are operated at low pressure for the dry kilns and the heating system, burning a part of the refuse. The greater part of the refuse is sold either baled or loose and brings in an average of approximately $90.00 per month. The total power consumption has averaged about 6600 kilowatts, which corresponds to a load factor of thirteen per cent, which is low considering the size of the blower. A wagon shop was changed from steam drive to group and individual motor drive. The line shaft in the woodworking shop was divided into three sections and driven by two ten-horsepower and one fifteen-horsepower squirrel cage motors. Each motor is belted to a line shaft with a three to one pulley ratio reducing the line shaft speed to 280, about the standard value for woodworking shops. From these shafts are belted twenty-one different machines, including a pony planer, double spindle shaper, jointer, tenoning machines, drills, etc., a complete equipment for making large farm wagons. In addition there are several motors in the blacksmith shop which bring the total to fifty-three-horsepower. One installation here is to be particularly noted. A small so-called trip hammer of uncertain manufacture was equipped with a double speed reduction by belting from the motor pulley on the ceiling to a shaft countershaft which in turn was belted to a pulley on the crank shaft of the hammer. A belt tightener on the second belt is used to vary the speed and the force of the blow. The motor is a two-horsepower squirrel cage type. In the pattern shop of a mining supply company a small Dennis Machine Company drill, driven by a one-horsepower squirrel cage motor is to be materially simplified by a slight change in the method of connection. The vertical drill shaft is driven by a pulley with its face vertical, the belt for it running over two idler pulleys and to a pulley at the base of the machine, its face being horizontal, so that the belt has a double twist as clearly shown in the illustration. The countershaft at the base is driven from the motor on a post at the rear of the machine. The simplification consists in eliminating the counter shaft and the two idler pulleys and the quarter turn belt by connecting a vertical motor to the same post that carries the motor at present, and belting direct to the drill spindle. An example of an unexpected application of a direct current motor was found in a feed mill doing a general feed mill business. One Nordyke & Marmon attrition mill with twelve-inch rolls, an elevator for the grain and a freight and passenger elevator, one Nordyke & Marmon Hexagon Scalper mixing mill and an elevator for unloading from the cars, are driven from the twenty-horsepower, 600-volt, compound wound, direct-current motor. The motor is belted to a large wooden pulley on a short countershaft from which the other machines are belted. Some consideration was given to the installation of a gas engine, but it was found that the fire insurance rate would be increased and that there would be no saving in the cost of power, so that electric drive was installed.

Owing to the limited amount of time available there was no discussion of Mr. Glass's paper, it being announced that any further information could be obtained by applying directly to Mr. Glass at the Westinghouse Electric and Manufacturing Company.

"The 220-Volt Problem," by Prof. George D. Shepardson, was the next paper presented at this session. A somewhat extensive abstract of this paper is given in the Central Station section of this issue.

The discussion following this paper was necessarily brief. It was pointed out by Mr. Gordon that most central stations adopt the 220-volt sytem on account of the small first cost.

Mr. Strong asked if any delegate present had had experience with 220-volt tungsten lamps. Several affirmative answers were given and in each case the lamps had given satsifaction.

Wednesday afternoon was devoted to an inspection tour through the large flour mills of Minneapolis and also a visit to the turbine plant of the Twin City Rapid Transit Company. Competent guides were provided and many features of interest pointed out on the trip.

THURSDAY SESSION.

The session on Thursday morning was opened with the presentation of a paper by Louis Friedman, entitled, "The Intensified Arc Lamp for High Class Indoor Lighting."

This paper pointed out the various types of illuminants in use and mentioned the advantages of each. The features of construction of the enclosed arc lamp were compared with the intensified arc lamp and the advantages of the latter explained. In the intensified arc lamp three carbons (two upper and one lower) are used, the upper carbons converge at an angle of about twenty degrees coming in contact with each other at their lower ends. With this arrangement a stationery arc is obtained so that the distribution of light is the same at all times regardless of the burning away of the carbons. The lower carbon feeds up similar to the practice in the luminous arc lamp which has proven to be the better practice. The upper carbons are six and the lower carbon 9.5 milimeters in diameter. With the use of these small carbons the distribution of light is equal in all directions around the lamp, there being practically no wandering of the arc

owing to the small surface of carbon at the point where the arc is maintained. By using these small carbons and the same amount of current as ordinarily consumed by arc lamps, the current density has been raised, hence a higher efficiency is obtained as the entire carbon points are raised to a high state of incandescence. An efficiency of one watt per mean hemispherical candle is obtained and when rated in accordance with the incandescent practice (maximum angle, clear globe, without reflector), the efficiency is approximately .83 watt per candle. The design of mechanism is such that it gives better regulation than any other lamp on the market, hence producing a perfectly steady operation. The intensified arc lamp is in every sense of the word a central-station man's lamp. The first cost as well as the maintenance is low, the efficiency is high and it promises to be the most successful of illuminants of high class indoor lighting. The fact that the lamp is of ornamental design, no expensive fixtures are necessary, as in the case of other illuminants as the intensified lamp is in itself of exquisite design.

President Gille asked Mr. Friedman if there was an alternating-current intensified arc lamp on the market. In replying Mr. Friedman said that the direct-current lamp was developed first on account of the demand but the alternating-curent lamp was nearing perfection and would soon be placed on the market.

Mr. Clark asked Mr. Friedman why the intensified arc lamp had only been recommended for indoor use. Mr. Friedman said that the lamp had been designed primarily for indoor use, but could also be used satisfactorily for outdoor illumination. Mr. Clark also asked what combination of globes has proven the most satisfactory. Mr. Friedman answered that when the lamp was hung twenty-five feet from the floor the single globe was effective, and when hung above that point the double globe gave better results.

The next paper was one entitled "Grounding of Secondaries," and was presented by Fred G. Dustin. An abstract is given below.

From the Underwriters' viewpoint, the word "safety" means that condition which gives freedom from fire-hazard; while life insurance companies would term it "an elimination of personal risk." Central-station companies are naturally concerned with having their electrical equipment equally safe as regards both life and property loss. The company's interest is even broader. It includes the welfare and integrity of its customers' wiring and apparatus. Whenever a loss of life or property is traceable to electrical deficiencies or imperfections, whether in the premises of the central station or of one of its customers, the company usually sustains a more or less serious commercial, if not financial loss. With alternating-current systems we must constantly guard against unknown pressures which may possibly run as high as fifty or sixty thousand volts. This is equally important in the protection of both life and property, for, though a cross with a system or from one to five thousand volts pressure may occasion no immediate injury or burn-out, yet a heavy leak might occur, which, sooner or later, would result in disaster; and in the case of lightning or of a break-down from, or a cross with, a fifty thousand volt system, the probability of a fatality or fire is almost a certainty. We are, therefore, led to the conclusion that the only safe way to prevent an excessive voltage from entering buildings is to thoroughly ground the service wires outside the premises. Considerable differences has been found to exist in practice in the detailed methods of securing a good, reliable "ground." Besides many published recommendations of experts on this subject I have, in my letter files, the opinions from prominent men who not only advise strongly in favor of grounding the neutral wire of secondaries, but, moreover, condemn the practice of attempting to ground to anything but underground systems of piping, preferably water pipes. They also unanimously agree that absolutely nothing is to be feared with such an arrangement from electrolysis, and in substatiation of this belief, the St. Paul Gas Light Company, which supplies both gas and electricity, is grounding its secondaries to its own underground gas piping. It is indeed unfortunate that those having charge of municipal and corporation water systems do not appreciate this fact, and that that through their disapproval of such grounding so many accidents have resulted.

I am hopeful, however, that the day is not far distant when such hydraulic engineers and water boards will not only consent to such bonding of secondaries to water pipes, but will assist us in requiring same.

ROBERT W. CLARK,

President-elect of the Minnesota Electrical Association. Mr. Clark, who is chief commercial agent for the Minneapolis General Electric Company, is a well-known central-station man in the Northwest, having had an experience of sixteen years in the central-station field, covering every department of the work. He takes an active interest in central-station affairs and has been a leading spirit in the Minnesota Association.

Mr. Kemper opened the discussion by commending the views of Mr. Dustin and saying that he hoped members of the association who also operated waterworks would go on record as approving these views.

Thomas Pitts asked Mr. Dustin how frequent was it necessary to make ground connections in this way in a distribution system. In replying Mr. Dustin said that one good ground was better than several poor ones. Mr. Pitts also asked if lightning arresters could be attached to the same ground. The answer was in the affirmative.

Mr. Hale, of the Boston Edison Company, cited his experiences in this matter. He said that the Boston company adopted the system some time ago, but it was unsatisfactory. It now grounds every service on the customer's premises. All of the older services were grounded at the company's expense, but the new customers were required to pay for their installations. Mr. Hale said that the Boston Edison Company was now considering grounding the secondaries to the neutral in the four-wire, high-tension systems.

The last paper presented was one entitled "Protective Apparatus for Electrical Circuits and Its Relation to Continuity of Service," by K. E. Van Kuren, of the Westinghouse Electric and Manufacturing Company. This paper described in detail the various types of apparatus on the market, and by means of lantern slides each type was clearly illustrated.

The election of officers for the ensuing year resulted as follows: Robert W. Clark, Minneapolis General Electric Company, president; E. Simmons, Marshall, Minn., first vice-president; F. Bateman, Cass Lake, Minn., second vice-president, and D. C. Gordon, Little Falls, Minn., secretary-treasurer.

ENTERTAINMENT.

On Tuesday evening the delegates assembled in the lecture room of the armory and were entertained by an excellent lecture by Prof. M. M. Wood on the gyroscope. By means of working models every feature was explained and illustrated. An interesting feature of the evening was the moving picture exhibit of the gyroscope.

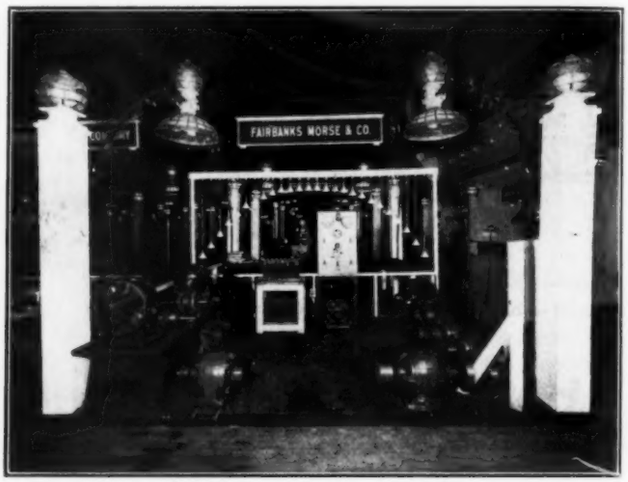
The manufacturers were the hosts of the Asociation on Wednesday evening at a banquet given in the Kaiserhof Restaurant. A very enjoyable evening was spent and the affair voted a grand success.

Consul Arthur Garrels, of Zanzibar, advises that two circuits of Marconi wireless telegraph have been installed on the Benadir coast in Italian Somaliland. One connects the posts at Mogodishe, Itala, Merka, and Lugh; the other Barawa, Giumbo, and Bardera.

Commissioner Moore on the Patents Situation.

"We are handing out today, in sixty per cent of the cases, patents that are almost worthless, in whole or in part," was the declaration made by Commissioner of Patents Moore, at a hearing before the House Committee on Patents, as shown by the report of the hearing, just issued. "No other country does that," he added. "We are away back in that matter. We have been asleep. Germany has a vastly superior system to ours. So has Great Britain. I have been over there three times to investigate conditions in Europe. We are trying to build up this system so that it will be worth something. It is unwieldy now and if not braced in many directions it will fall of its own weight. German patents are better, because their applications are more thoroughly searched before patents are granted, owing, of course, to the better facilities afforded to the German Patent Office. The German patent is regarded as a greater validity, because they have the facilities for searching as to novelty. Their examination exhausts everything and Germany is thus enabled to guarantee the novelty of the invention; the Government makes that guarantee of the patent, throwing the burden of proof on the infringer. In this country the board of examiners is a judicial body and passes upon a great quantity of cases where large monetary interests are at work. I could cite you many cases where influences are brought to bear. I have been approached. There is hardly a day passes that some sort of influence is not brought to bear upon someone in our office, and I suppose every commissioner has felt the same thing."

GENERAL VIEW OF MINNEAPOLIS ELECTRIC SHOW.



FAIRBANKS MORSE & COMPANY.

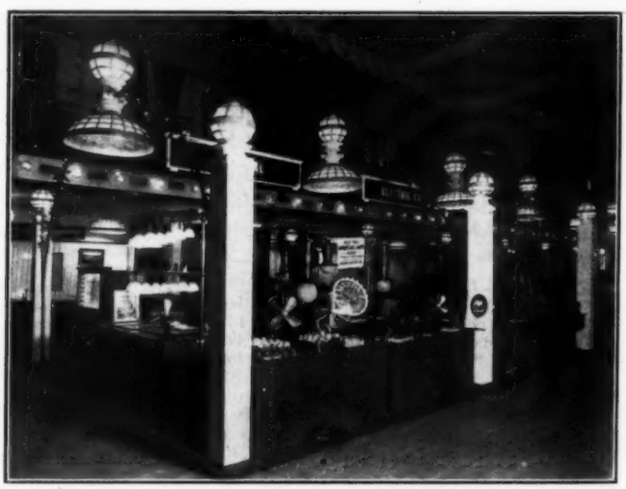
Minneapolis Electric Show.

The first electric show of Minneapolis, held under the auspices of the Northwestern Electric Show Association, March 26 to April 2 in the Armory of the Minnesota National Guard, fulfilled in every respect the promises of the promoters that the show would be a credit to the city, spreading abroad its fame as a city that does things and does them right.

The attendance during the show was larger than was expected, leaving nothing to be desired in this respect. The annual convention of the Minnesota Electrical Association, a report of which appears on other pages of this issue, was held in the Armory during the week of the show, thus including in the attendance central-station men from all points in the state.

The show was primarily of an educational nature and visitors in every

CENTRAL ELECTRIC COMPANY.



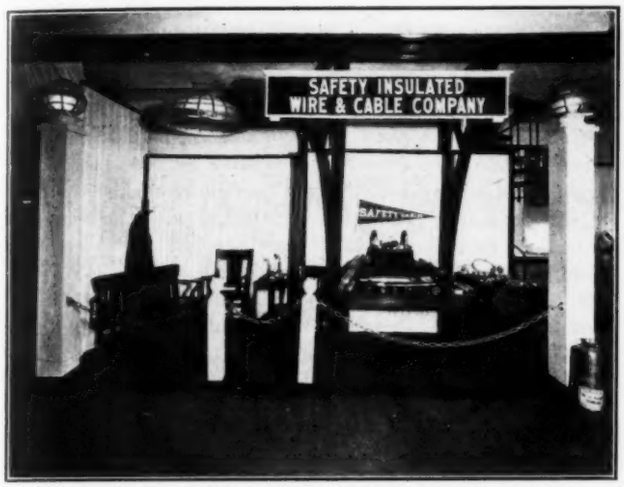
GENERAL ELECTRIC COMPANY.

walk of life found something of particular interest. For the manufacturer, keen to discover new methods of increasing production; for the merchant, looking for a novel method of illumination or advertising by means of electric light; for the owners of hotels, apartments or private residences, interested in cleanliness, comfort and labor saving and for the layman interested in electricity there were shown new ideas in the use of electricity and electrical apparatus and devices.

The amusement features of the show did much toward adding to the interest and expressions of appreciation were numerous in regard to the musical programme provided. The following is a list of special days on which added attractions were provided: March 28, Wireless Day; March 29, Minnesota Electrical Association Day; March 30, Ladies' Day; March 31, Aeronautics Day, and April 1, Telephone Day.

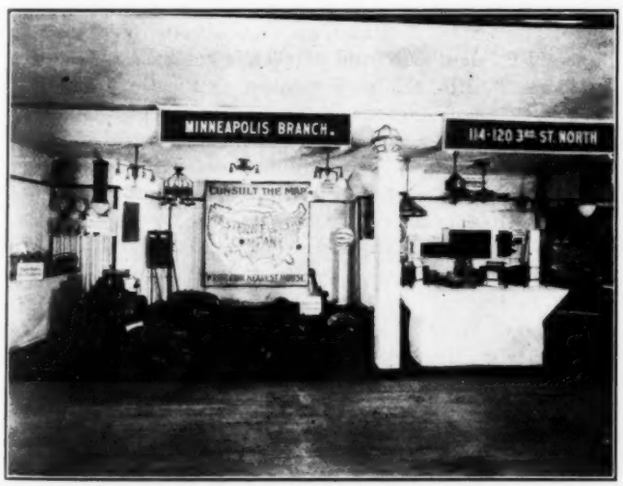
The association spared no expense in creating a lighting and decorative effect in keeping with the shows held in other cities and much credit is due Bertrand & Chamberlin, Minneapolis, Minn., who were responsible for the booth arrangements and decorations.

In the accompanying illustrations are shown views of several of the prominent exhibits, together with a general view of the auditorium.

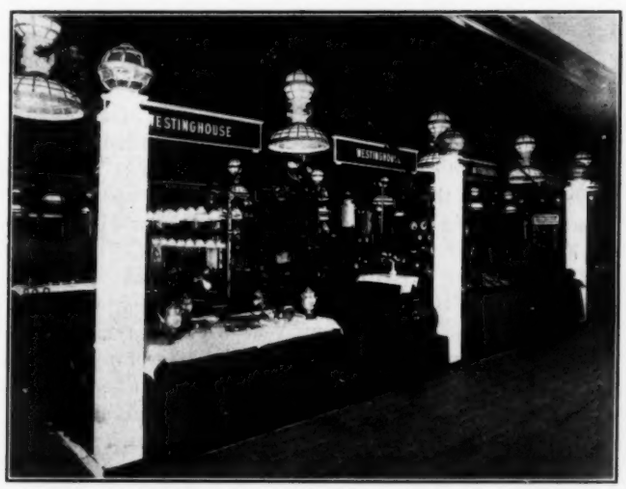


SAFETY INSULATED WIRE AND CABLE COMPANY.

NATIONAL ELECTRIC LAMP ASSOCIATION.



WESTERN ELECTRIC COMPANY.



WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

Street Railway Traffic in New York.

Figures showing the remarkable expansion during the past ten years in the railroad traffic in the city of New York are given in the April bulletin of the Chamber of Commerce. They are made up from a table prepared by the Public Service Commission and embrace the surface, subway and elevated lines. These figures and their per cent increase, compared with a ten-year increase in population, as given in the bulletin, are as follows:

	1909	1899	Per cent increase.
Population (increase between 1900 and 1910)..	.....	.....	32.79
Track mileage....	1,646	1,229	33.94
Pass. car mile. (est)	272,300,000	176,000,000	54.72
Fare passengers..	1,400,000,000	777,700,000	80.01
Transfer and free passengers (est)	314,000,000	220,000,000	42.72
Number officers and employes...	37,600	29,300	28.62
Rev. from transportation	$770,733,000	$39,855,000	77.47
Total rev. from rail operations..	73,646,000	40,945,000	79.89
Expense of rail operations	44,022,000	24,004,000	83.39
Net revenue	29,624,000	16,941,000	74.80

It is pointed out that the number of fare passengers on the street railroads of New York 1,400,000,000, in 1909, compared with 873,905,133 passengers carried on all the steam railroads in the United States in 1907; that the track mileage in New York city is nearly equal to the distance between New York and Bismarck, North Dakota, and that the net revenue per track mileage in 1889 was $13,784 and in 1909 $18,000.

Electrical Notes From Great Britain.

By Our British Correspondent.

The metallic-filament lamp is making unhindered progress in all parts of the country in the lighting of public thoroughfares. Reference may be briefly made to a few recent changes which are typical of what is occurring pretty generally. Yarmouth, one of the most popular seaside resorts on the east coast, has 673 gas lamps costing $11,360 per annum. Some of these lamps cost $16.60 and others $17.40 per annum each, but it is proposed to substitute for them electric lamps costing $15 per annum each. The total yearly electrical cost being only $10,095 there will be a saving of $1,265 per annum. At present there are 282 electric lamps in the public streets costing $15.75 per lamp per annum, but as part of the scheme these are to be reduced to $15.00 each, so that there will be a further saving of $210 per annum. Eighty-candlepower lamps will be used. At Penmaenwawr a scheme is preparing for lighting the streets by 100-candlepower lamps. Hammersmith (London) has converted 550 public lamps from gas to 100-watt Osrams, and 400-candlepower lamps of the same type are in service in special thoroughfares. At Liverpool one street is being changed from 2,460 candlepower (gas lighting) to 10,000 candlepower electric. Acton is experimenting with fittings containing three 100-candlepower Osrams with reflectors. Hampstead (London) Borough Council is converting 159 street gas lamps in Cricklewood, Kilburn and West End, into electric, with two thirty-five-watt metal-filament lamps in each lantern; this is the beginning of the changing over of 2,237 gas lamps. It will bring an immediate saving of $2,935 per annum, and one of $13,745 per annum at a later date. Islington (London), which has a lot of street electric arc lighting, is substituting thirty-one metal filament lamps in the existing gas lamp columns. In the city of London more electric street lighting experiments are to be conducted.

Following up our comments of last month on the recent criticisms of the Institution of Electrical Engineers and its policy of aloofness from sectional commercial interests, we should add that the Institution Council replied to the request of one of its members, stating that it did not consider that it lie within its proper scope to form the suggested organization. Another Provisional Committee of gentlemen, more or less prominently associated with electrical interests, has since announced its constitution "to take such steps as may be found advisable in furtherance of the legislative, industrial and commercial interests of electrical industries," every effort being made to work "in co-operation with all existing electrical societies." Dr. Gisbert Kapp, the president of the institution, speaking on this question at the Manchester Section dinner, said that the institution existed for the advancement of electrical science, and its application for the use and benefit of man. Some people wanted this interpretation widened, but the institution would not make itself a machine for the promotion of selfish interests, and he objected to politics being introduced. At the present moment Government Departments respected them and consulted them because of their strict impartiality. W. M. Mordey, last year's president, followed by saying that all efforts to make the Institution a Masters' Association, or a Trade Union, must be resisted.

Further electric lighting companies have been relating their latest experiences of the effect of metal-filament lamps on their undertakings. Smithfield Markets Electric Supply Company (London) has had its profits reduced almost to a vanishing point, the revenue per lamp having fallen from about $1.85 in 1909 to about $1.40 in 1908. The company is only a small one and has a restricted area—chiefly shops—in which very few gas consumers still remain. The only way to live, therefore, has been to announce boldly to all and sundry an increase in prices of current to all using metal-filament lamps. At first there was a mild sort of revolution in the markets, and a threatened boycott, but things have now quieted down, though there is still a chance of "developments at quarter day." The Charing Cross and City Electricity Company (London) estimates that the loss of sales caused during last year by the use of metallic-filament lamps, was not less than $50,000, and it is thought that for all practical purposes the company is half through its troubles in this matter. The chairman said that notwithstanding these effects the advent of the lamp was not "an unmixed curse," as it would benefit them in future. In alluding to the business of the past ten years, he said that "it cost them fifty per cent less now to produce energy than in 1900, but the average selling price was forty-five per cent less." Incidentally it may be remarked that the company is satisfied with the economy obtained from the use of oil as fuel, and it is going to extend its use in another station. In its 1909 efforts at economy the company reduced its generating costs by ten per cent. The London Electric Supply Corporation states that during 1909 it connected more lights than ever before in a single year, but owing to the continued installation of metal-filament lamps the increase in lighting units was almost stationary, being only 53,000 units. The increase of lamps for last year would, on the old lamp basis, have meant an increase in lighting units of no less than 780,000. It appeared, therefore, that the yearly increase of lamps about neutralized the decreased consumption due to the new lamps.

The business of the National Telephone Company, Limited, continues to expand at a satisfactory rate, but the date of transfer to the Government is now very near. For the past half year there has been an increase of about $508,000 in income, with an advance of $321,000 in working expenses. The total income was $8,000,000 and the expenses were $4,614,000. The Post Office received in royalties $770,000, an increase of $139,000. There have been erected 13,896 additional exchange and private stations. It was stated at the recent meeting that since the commencement of the business there had been paid in royalties to the Postmaster-General over $16,000,000. The company has spent more than $500,000 less this half year on the construction of exchange and private stations in accordance with the directors' policy, already referred to in this journal, of restricting capital expenditure in view of the approaching termination of the license.

A company has just made its bow

to the investing public in London under the title of "The Lobito, Benguella & Catumbella Electric Light and Power Company, Limited." It is to acquire concessions from the municipalities of Benguella and Catumbella for electric light and power supply in these towns, and it will also supply the port of Lobito, Portuguese Southwest Africa. A waterfall on the Catumbella River will be utilized. At dry seasons this will develop 4,000 horsepower, which can be increased by heightening the dam, though the present requirements of the company will be only 800 horsepower. The monopoly is granted for ninety-nine years by the Portuguese Government. Sir Douglas Fox and Partners, of London, are the consulting engineers to the company, and the Peninsular Development Syndicate is under contract to construct the plant. ALBERT H. BRIDGE.

London, March 26, 1910.

The Northern Indiana and the Southern Michigan Deal.

A lot of misinformation has been sent out relative to the deal between the Northern Indiana and Southern Michigan Traction companies, according to Samuel Murdock, secretary of the former company.

"None of the details of the future operation of the Southern Michigan railway has yet been worked out," said Mr. Murdock. "All that has been accomplished is the practical completion of arrangements whereby the stock of the company will be taken over by the Northern Indiana." Mr. Murdock said that everything necessary for putting the road in good condition would be done. S.

Electric Traction Experiments in Switzerland.

Consul George Heimrod, of Berne, makes a report on the resumption of steam locomotion on the branch of the Swiss Federal Railways between Seebach and Wettingen, after several years electric traction experiments by a machine company. The experiments, however, resulted in overcoming the difficulties caused by the influence of high voltage upon low voltage, and further the effective use of single-phase current. The consul's detailed report is on file for public reference at the Bureau of Manufacturers, Washington, D. C.

Joint Meeting of the Western Society of Engineers and the Chicago Section, American Institute of Electrical Engineers.

At the joint meeting of the Electrical Section, Western Society of Engineers, and of the Chicago Section, American Institute of Electrical Engineers, held on Wednesday evening, March 23, in the Western Society's rooms, a very interesting paper entitled "The Diversity Factor in the Distribution of Electric Light and Power" was presented by H. B. Gear of the Commonwealth Edison Company of Chicago.

In the distribution of electricity over a large city for lighting and power purposes, the maximum demand of the day upon the distributing system varies on different days of the week and in the different months of the year. The effect of the varying lengths of the day, due to changing seasons, habits of the population served, and the character of the district, combine to produce this condition. Mr. Gear explained the varying conditions of the different classes of service, explaining when the maximum demand comes for each class of customer in the different seasons of the year, and said that the combined effect of all these influences is to produce a smaller maximum demand as the point of supply is approached.

Mr. Gear defined the diversity factor as being the ratio of the sum of the maximum of the sub-division of the distributing system to its actual maximum demand as observed at the point of supply, and taking a specific case as an example said that if the sum of the individual maximum loads on the ten feeders of a substation was 1,200 kilowatts and the co-incident maximum of the feeders is 1,000 kilowatts, the diversity factor is 1,200 divided by 1,000, or 1.2.

The study of the diversity factor, according to the speaker, is of great importance from a commercial point of view. The investment required by the central station company in the various parts of its operating system for each kilowatt of its maximum demand determines the fixed charges which must be considered in determining costs and in making an equitable system of rates.

The larger the system the greater the diversity factor, and for the purpose of his discussion Mr. Gear considered an alternating-current system supplied by substations, feeders, transformers, etc., as existing in Chicago.

Starting wtih the customer as the originator of the demand for electricity, Mr. Gear said that observations made in residence districts supplied by overhead lines indicate that the maximum demand by individual consumers is from two to three times the co-incident maximum demand on the transformer, the ratio being lower where there are less than ten consumers on a transformer and higher where there are more than thirty.

In commercial districts with numerous small stations supplied by overhead lines, the co-incident demand is much higher in proportion to the consumers' demand. The ratio of the sum of consumers' maximum to the co-incident demand in this class of lighting was found to be from 1.5 to 1.7, it being lower where there was considerable display lighting, show windows, etc., and higher where the shops were of such a character that not all the lighting was needed continuously.

Regarding power consumers, Mr. Gear said that they are not often grouped so that any considerable number can be supplied from one transformer installation. They must be kept separate from lighting, and, therefore, usually require a separate set of transformers for each consumer where the load is two horsepower or more. For large installations an advantage is taken of the diversity between the meters to reduce the transformer capacity installed.

Considering the substations next, the speaker said that the next point at which diversity may be conveniently observed is at the feeder switchboard. He said that there is a considerable diversity factor between the sums of the transformer maxima and the maximum feeder load. The factor in this case varies with the character of the territory served, and with the density of the load. In the substation there is a diversity factor due to the difference in the character of the load carried by the different feeders. The maxima on the power feeders occur during the daylight hours, while the maxima on lighting feeders varies from 5:30 p. m. in commercial lighting to 7:00 p. m. in residence lighting.

With three-phase distribution there is a diversity factor between phases where the lighting is carried single-

phase. The speaker stated that the net result is that in a substation with ten or more feeders, the diversity factor averages about 1.15. In the substation supplying power and general lighting it is likely to be as high as 1.2, while in a residence district with little power load it is about 1.1.

For the purpose of showing total diversity factor from the substation to the consumer for various classes of business the following table was given:

	Residence	Commercial light	Scattered power	Large power or light
Substation to Feeders	1.15	1.15	1.15	1.15
Feeders to Transformers	1.8	1.25	2.0	1.25
Transformer to Meters	3.0	1.6	1.1	...
Total Diversity Factor	6.2	2.30	2.53	1.44

Mr. Gear said that the reduction in the amount of capacity required in generating and distributing equipment makes a corresponding reduction in fixed charges, which form a large part of the cost of producing electricity.

The investment cost is further reduced by the ability to use large generating units, which cost less than half as much per kilowatt than the cost of generating machinery in sizes commonly used in independent plants.

The merging of all these demands has also, according to the speaker, a pronounced effect on operating costs, in that the load factor of the generating station and distributing system is very much higher than that of the consumers who take their supply from it. This permits the station to be run at an economical load a large part of the time, thus reducing both labor and fuel cost per unit for generators.

The investment per kilowatt varies considerably with the type of construction and the geographical situation of points of supply and delivery, it being considerably more for underground lines than for overhead. Mr. Gear gave the following figures to show in

	Scattered residence.	Dense residence.	Commercial light.	Large power or light.
Generating capacity	18.5%	30.%	44 5%	60.%
Trans. line & Substa.	4.5	7.5	10.5	14.
Feeders, mains	52.	26.	35.	23.
Transformers	4.	2.5	3.	3.
Meters	21.	34.	7.	negligible
Investment per kilowatt of annual maximum demand on generating station	$820	$500	$350	$250

a general way how the investment is distributed between various parts of the system under a fairly representative set of conditions. He said that these figures were compiled presuming the average cost of the meter to be $10; light transformer to be $7 to $10 per kilowatt; transformer substations and transmission lines at $35 per kilowatt, and generating capacity at $150 per kilowatt.

After a brief discussion of the table, Mr. Gear concluded by emphasizing the importance of the diversity factor in the construction of rates for light and power, and explained that the important function of this factor was the basis of calculations of the Commonwealth Edison Company.

George D. Lukes, superintendent North Shore Electric Company, who presided at this meeting in the absence of Secretary Lake, called upon W. B. Jackson to open the discussion. Mr. Jackson commended the paper presented by Mr. Gear, and spoke in favor of the significant points emphasized.

Following Mr. Jackson, W. L. Abbott, chief engineer Commonwealth Edison Company, said that the question of diversity factors is a fundamental and vital one with central stations. He said about two-thirds of the operating expenses of central stations are for items which can only be reduced in relative volume by making the equipment carry the greatest load. The diversity factor as applied to residence lighting, where the maximum demand is not great, is one feature of the question, and the fact that the householder when away from his house is not using current is another feature. Mr. Abbott said that it was a common occurrence in winter for both business and residence district to require the maximum demand, and this results in the fact that about one-quarter of the general investment of the central station is for supplying service for thirty or forty days of the year when the demand is the greatest. At this time, although current is sold for about ten cents per kilowatt-hour, it costs the company approximately $1.00 per kilowatt-hour. Messrs. Fowle, Bement and Woodworth also contributed to the discussion.

Saving Money on Coal Purchases.

The city of New Haven, Conn., has decided that the coal supply for all city departments for the entire year should be purchased in one contract, and that spring, the most favorable time of year, when the price is lowest, should be selected to purchase. It is expected that this method of buying will save the city between $4,000 and $5,000 a year.

First Annual Meeting of the New England Section of the N. E. L. A.

The first annual meeting of the New England Section of the National Electric Light Association was held in Boston on March 16 last, with an opening attendance of about 200 and a final registration at the close of 455, facts which speak well for the complete success of the meeting and of the commendable interest displayed therein.

President S. Fred Smith, of Salem, Mass., in his opening address, announced that the membership of the section totaled 564, with about fifty applications pending, this being more than double the number of members last year. The New England Section is thus the largest branch of the N. E. L. A., and its relations with the parent body are of the most cordial kind. Among other things, Mr. Smith spoke of the necessity of educating the public to a proper view of the motives of the central stations.

T. Commerford Martin, executive secretary of the national organization, who was next introduced, mentioned that during the past five months the N. E. L. A. had increased in membership from 3,200 to 4,800, which was evidence of the growing tendencies of the central-station industry and of its influence and increasing effectiveness. Branches are being promoted or proposed in such states as Georgia, Virginia, West Virginia, North and South Carolina, Wisconsin, Nebraska, and Michigan.

The first of the four papers presented at the meeting was by J. C. Hutchings, general manager of the Rochester (N. Y.) Railway & Light Company, who took for his subject "The Attitude of Central Stations Toward Electric Automobiles." An abstract follows:

In the electric-vehicle business the principal requirements are a good vehicle, suitable battery, low mechanical friction, proper battery charging and maintenance. The field of usefulness of the pleasure vehicle is the greater the less the energy required to run the car; with the commercial car the question of cost is paramount. To obtain the best results from the battery, the discharge on a day's run should be about seventy-five per cent of the charge, and this latter should be within the capacity of the battery which should be large enough in size to accommodate it. For a day's run of sixty or sixty-five miles the Rochester company

prefers the thinnest possible plate in the lead type of battery, while for heavy trucks of small mileage capacity the heavy-plate battery was giving excellent service. With regard to friction losses, the author asserted that an increase of twenty-five per cent in friction will usually reduce the effective work of the vehicle by more than one-half. Therefore, complete inspection and lubrication records of the cars were recommended, these to be submitted by owners to the central stations who look after the cars. In order to induce the customer to have his car charged in off-peak times, a two-rate schedule should be adopted. This is done in Rochester by charging three cents per kilowatt-hour during off-peak hours, with suitable discounts for quantities. Two meters in series are used, the high reading instrument being automatically cut out by a clock during preferential hours. In the experience of the Rochester company in operating eleven trucks and eight runabouts in its own work, a saving of twenty per cent over horse service was shown, after making generous allowances for interest, depreciation, replacements, charging, etc. The policy of the company in inspecting the cars of its customers and in giving the latter expert advice, had resulted in increased sales of energy for charging electric vehicles.

The second day's session was opened on Thursday by the introduction to the meeting of F. W. Frueauff, president of the N. E. L. A. Mr. Frueauff made a characteristic address in which he noted the satisfaction of the officers of the national organization regarding the loyalty of the New England Section.

W. H. Blood, Jr., past president of the N. E. L. A., then read a paper on "Insurance from the Engineer's Standpoint." Starting with the general principle that insurance is necessary because of its dealing with averages instead of individual cases, the author reviewed the case of self-insurance for a company operating a large number of properties in several cities, which, he said, should not entirely cut loose from the regular insurance companies until it has created a fund sufficient to care for a complete loss on several of its large hazards.

President Frueauff next addresesd the meeting and outlined briefly the plans for the St. Louis convention. He spoke of the plans to bring hydroelectric enterprises more into public favor, which policy would be forwarded by the establishment of a new transmission section of the association.

T. Commerford Martin again addressed the meeting and stated that the central-station industry has doubled every five years in investment, earnings and numbers of employes. He stated that the benefits of membership in the N. E. L. A. were of material value, and cited cases in which the advice from the organization's committee of experts had resulted in great savings to the companies to which it had been given.

The afternoon session was opened by a paper entitled "Increasing the Load on Existing Lines," by E. R. Davenport. This was an account of the methods adopted in Providence for increasing the motor service. A special bureau of three competent engineers and four assistants, all technical graduates, is employed. These men make it their business to study the requirements of any prospective customer, and, if necessary to effect a deal, to study his plant, analyze his motor requirements, and present a detailed report of the performance of the plant. A greatly increased business has accordingly resulted to the company, and only ten gas, gasoline, and oil engines now remain in the company's territory. Easy terms are given for the sale of electric motors, and co-operation with the contractors is also utilized. The company earns $28,000 annually from electric heating, free renewals of lamps for luminous being among the inducements offered for this class of business.

James E. Davidson, who discussed the paper, emphaized the importance of reliability in motor service, and mentioned the fact that since the Providence company had begun its motor business campaign, the load factor of the station had been increased by thirteen per cent.

On Thursday evening a banquet was given at which President Frueauff, Secretary Martin, and C. L. Edgar were among the guests present. Speeches were made by C. H. Hodskinson and C. L. Edgar.

L. D. Gibbs then read a paper by R. H. Hale (general superintendent of the Sales Department of the Boston (Mass.) Edison Company), entitled "Price of Electricity." This paper comprised an extensive analysis of the fundamental principles of price making, and a reply to criticisms of the methods adopted by the Boston Edison Company.

The following is the list of officers elect for next year: President, James E. Davidson, Montpelier, Vt.; vice-president, A. J. Campbell, New London, Conn.; secretary and treasurer, L. D. Gibbs, Boston; executive committee, J. A. Fleet, Portland; J. S. Whitaker, Portsmouth; H. T. Sands, Malden; R. W. Rollins, Hartford; F. H. Parker, Burlington, and A. B. Lisle, Providence.

C. H. Hodskinson, the retiring secretary and treasurer, on Wednesday evening gave a complimentary dinner to the executive committee and Secretary Martin at the clubhouse of the Boston Athletic Association.

Electrical Trade Opportunity in the East.

An American consular officer in the far east states that there is a considerable activity in electrical undertakings of various kinds in his district. He states that recently some desire has been evidenced to invest money in electrical and waterpower companies and this class of business should show considerable development in the near future.

There are now seventy-eight electrical companies awaiting charters, and in view of the promised development in this line of business he suggests that it would be to the interest of American electrical companies to send a representative to that country with power to make contracts, rather than to try to do business by correspondence.

Those writing for information should address the bureau of manufactures, Department of Commerce and Labor, Washington, D. C., referring to file No. 4628.

To Improve Chicago Street Car Service.

Another drawback to traffic in the Loop district of Chicago has been removed. At a meeting of the Street Traffic Committee of the Chicago Association of Commerce it was reported that arrangements have been made with the traction companies interested by which crews will no longer be permitted to transfer from one car to another on bridges, bridge approaches or anywhere in the Loop district. Such transfers as a rule consume from five to seven minutes and the new ruling was suggested because of the congestion in the downtown district such delays occasion.

AN INTERNATIONAL CO-OPERATIVE INVESTIGATION ON ELECTRICAL STANDARDS.

BY EDWARD B. ROSA.[1]

The International Electrical Conference, which met in London in October, 1908, passed certain resolutions with regard to electrical units and standards, but left to an international committee, which was established at that time, the duty of completing the specifications for the concrete electrical standards, and of deciding upon a new numerical value for the Weston normal cell which could be adopted internationally.

As is well known, the value for the Clark standard cell (1.434 volts at fifteen degrees Centigrade) which was adopted by the Chicago Electrical Congress in 1893, was not accepted by Germany. After further experimental investigations, Germany adopted the value, 1.4328 volt at fifteen degrees Centigrade. England, America, France and some other countries have followed the Chicago Congress, whereas other countries have followed Germany, and hence there have been two different values for the volt in use.

In course of time, the method of preparation of the Clark cell was improved so that the cell became more reliable, but at the same time its electromotive force was slightly altered. At the United States National Bureau of Standards an allowance was made for the change in the electromotive-force of the Clark cell, so as to preserve the unit of electromotive force unaltered. In England, however, the original numerical value was retained in spite of the fact that the new cells had slightly different values from the old. The result was that a discrepancy arose between the values in use in England and America. Hence, there were and still are three different volts in use in different countries. The Weston normal cell, officially adopted at the London Conference in place of the Clark cell, has the following values. In America, 1.0189 at twenty-five degrees, equivalent to 1.019125 volts at twenty degrees; in Germany, 1.0186 volts at twenty degrees; in England, 1.0184 volts at twenty degrees. Some of the other countries have the same value as America, others the same as Germany. England adopted the last named value only one year ago, and no other country, as far as known, has followed its example.

The London Conference of 1908 adopted the ohm as represented by the resistance of a specified column of mercury, and the ampere as represented by a certain mass of silver deposited in a silver voltameter, as the two independent fundamental electrical units, and declared that the value of the volt should be derived from these two. The electrochemical equivalent of silver adopted at London was 1.11800 milligrams of silver per second per ampere of current. It was known that different investigators had obtained different values for the electrochemical equivalent of silver, according to the kind of voltameter used and the methods of preparing the silver nitrate, so that the international committee found itself confronted with the problem of preparing specifications for the voltameter, when there was a great difference of opinion as to the proper procedure and as to the true value of the electrochemical equivalent of silver, which had, however, been definitely fixed by the conference.

The International Committee on Electrical Units and Standards is authorized by the London Conference to complete the work of the conference and to carry on intercomparisons of standards among different countries, and to promote investigations upon the subject of electrical units and standards, to the end of securing international uniformity with the highest obtainable accuracy. This committee represents eleven different countries, there being two members each from America, England, France and Germany, and one member each from Austria, Italy, Russia, Switzerland, Holland, Belgium and Japan. The president of the committee is Prof. Dr. E. Warburg, president of the Reichsanstalt, Berlin; vice-president, Dr. R. T. Glazebrook, director of the National Physical Laboratory, London; treasurer, Prof. S. W. Stratton, director of the Bureau of Standards; secretary, Prof. E. B. Rosa, physicist of the Bureau of Standards. The other eleven members of the committee are as follows:

Dr. Osuke Asaho, Department of Communications, Tokyo, Japan.

M. René Benoit, Bureau International, Sèvres, France.

Dr. N. Egeroff, director, General Chamber of Weights and Measures, St. Petersburg, Russia.

Prof. Eric Gérard, Liége, Belgium.

Prof. H. Hage, Grossingen, Holland.

Prof. Ludwig Kusminsky, Commission of Weights and Measures, Vienna, Austria.

Dr. Stephen Lindeck, Physikalisch-Technische Reichsanstalt, Berlin, Germany.

Prof. Gabriel Lippmann, The Sorbonne, Paris.

Prof. Antonio Roiti, Florence, Italy.

A. P. Trotter, Electrical Standards Laboratory, Whitehall, London, Eng.

Prof. H. F. Weber, Zürich, Switzerland.

In addition to the fifteen members appointed by the International Electrical Conference, the committee was authorized to elect associate members to assist in carrying on its work, and at its first meeting in London, following the conference, five associate members were elected as follows: Dr. W. Jaeger, of Berlin; F. E. Smith, of London; Prof. Paul Janet, of Paris; Prof. H. S. Carhart, of Ann Arbor, Mich.; and Dr. F. A. Wolff, of the Bureau of Standards, Washington.

It was impossible to select a new value of the Weston normal cell in terms of the ohm and the ampere until the latter should be more precisely defined than had been done by the London Conference. Correspondence among the members of the committee who were connected with national standardizing institutions, seemed to indicate that it would be impossible to agree upon the specifications of the silver voltameter without further investigation, and it was proposed by the American members of the committee that a joint investigation to clear up, as far as possible, outstanding problems on the standard cell and the silver voltameter be arranged with representatives of several of the national standardizing laboratories as participants. Prof. S. W. Stratton in his capacity as director of the Bureau of Standards offered the facilities of the Bureau of Standards for an international investigation, and in his capacity as treasurer of the International Committee on Electrical Units and Standards offered to secure the funds to pay the expenses of the investigation. In this connection he received valuable assistance from John. W. Lieb, Jr., New York, who placed the matter befor the governing bodies of the American Institute of Electrical Engineers, the National Electric Light Association, the Association of Edison Illumi-

1 Secretary of the International Committee on Electrical Units and Standards.

nating Companies, and the Illuminating Engineering Society. These four societies made appropriations of $500 each to defray the expenses of the proposed investigation. Their generosity in this matter is highly appreciated by the International Committee on Electrical Units and Standards. Some smaller contributions were also received.

It was arranged that the proposed investigation should be carried out at the Bureau of Standards by representatives of the Bureau of Standards, together with one delegate from the Physikalisch-Technische Reichsanstalt, Berlin, one from the National Physical Laboratory, London, and one from the Laboratoire Central d'Electricité, Paris. These delegates, as appointed by the directors of the several institutions, are Prof. W. Jaeger, F. E. Smith, and Prof. F. Laporte. These gentlemen have had a very considerable experience in work with standard cells and silver voltameters, have published various investigations on the same, and are eminently qualified to represent their respective institutions and to join in the work of research and deliberation upon the various questions that will arise during their stay in Washington. The representatives of the Bureau of Standards are Prof. E. B. Rosa and Dr. F. A. Wolff. In addition to published papers, a great deal of experimental work has been done at the Bureau of Standards, which is not yet published, which throws considerable light upon the questions at issue.

In addition to the work on standard cells and the silver voltameter, a comparison is to be made of the resistance standards of the several national standardizing institutions. The wire standards of the Reichsanstalt, the National Physical Laboratory and the Bureau of Standards differed only about two parts in a hundred thousand at the last intercomparison about a year ago, the standards of the first two of the above institutions having been fixed independently by legally specified mercury ohms. It is expected that a common value of the international ohm will be agreed upon, so that no difference greater than one part in a hundred thousand will exist between the wire standards of the national standardizing institutions.

It is confidently expected that the committee will succeed in coming to a satisfactory agreement with respect to the official specifications of the silver voltameter and the Weston normal cell, and will be able to agree upon a value for the latter which can be recommended to all countries of the world for adoption. The degree of accuracy which is now obtainable in electrical measurements, both in absolute measurements and in relative measurements, far surpasses what was possible in 1893, and indeed has increased greatly within the last five years. There is reason to believe that values adopted now will be satisfactory for a generation at least without change. The European delegates have brought with them, from their own laboratories, a quantity of apparatus and chemicals in order that they may reproduce work done in their own laboratories at the Bureau of Standards, as accurately as possible. Standard cells will be set up by the representatives of each of the four institutions, and accurately compared and tested. In the same way different forms of silver voltameters will be operated in series with one another, and the quantity of silver deposited in each determined with very great accuracy. The Bureau of Standards has provided every facility for carrying on this work expeditiously and with the highest precision.

The three European delegates arrived from Europe recently, and proceeded to Washington after a short stay in New York, in time to begin their work at the appointed time, April 1. It is not known how long the work will continue, but it is hoped to complete it in two months.

Steam Railway Electrification.

On March 29, a joint meeting of the Washington section, American Institute of Electrical Engineers and the Washington Society of Engineers, was addressed by Prof. John W. Whitehead of Johns Hopkins University on the subject of "Steam Railway Electrification."

Dr. Whitehead pointed out that the adoption of electrification depended on both the physical conditions and the cost. Out of a total railroad mileage in this country of 220,000, only about 1,000 miles have been electrified so far. This includes the terminals and tunnel trackage in New York, Baltimore, St. Clair and Cascade tunnels, etc. The advantages of electric operation include speed, comfort, acceleration, tractive effort and headway. On the New York City elevated roads, fifty per cent increase in capacity resulted from eletrification.

Terminal and suburban, express, and freight service were treated separately, with a consideration of the conditions affecting each. In each case electric operation is not only possible, but under advantageous conditions decidedly preferable. The great advantage of electric operation is in the centralization of power generation; its weakest feature is in the feeding of power over a transmission line, for if this fails, operation must shut down. The relative dangers of the two systems was considered.

Turning to the question of costs, the speaker stated that the conducting of transportation, the main item of difference in the two systems, is about fifty-six per cent of the total cost of operation. From a consideration of the different items, it was shown that where ten or more trains a day were operated, a saving of twenty per cent of the cost could be effected under this heading by electrification.

The different methods of electrical operation were next considered, direct current at 600 volts being the most common. Most alternating-current equipment is for single-phase, series, commutator motors, although at the Cascade Tunnel on the Great Northern Railroad, three-phase induction motors are used. About 1,000 miles of road are being operated on alternating current, although the Washington, Baltimore & Annapolis road has recently abandoned this for direct current at 1,200 volts. The great advantage of alternating curent lies in transmission at high voltage, a transformer in the locomotive serving to reduce to working voltage. Sub-stations can therefore be widely separated, and copper costs also kept down. Line voltage as high as 15,000 volts has been used in this way.

Stevens Institute Asks Exemption from War Tax.

The Stevens Institute of Technology, Hoboken, N. J., has taken active measure to recover a sum of $45,000 which was paid to the United States Government as an inheritance tax in 1870. Other universities taxed at the same time which delayed payment were later made exempt by special laws.

Promptness in payment was the real cause of the institute's loss, and it is on this ground that it is seeking to recover the money.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

ELECTRICAL EQUIPMENT FOR COAL MINES.

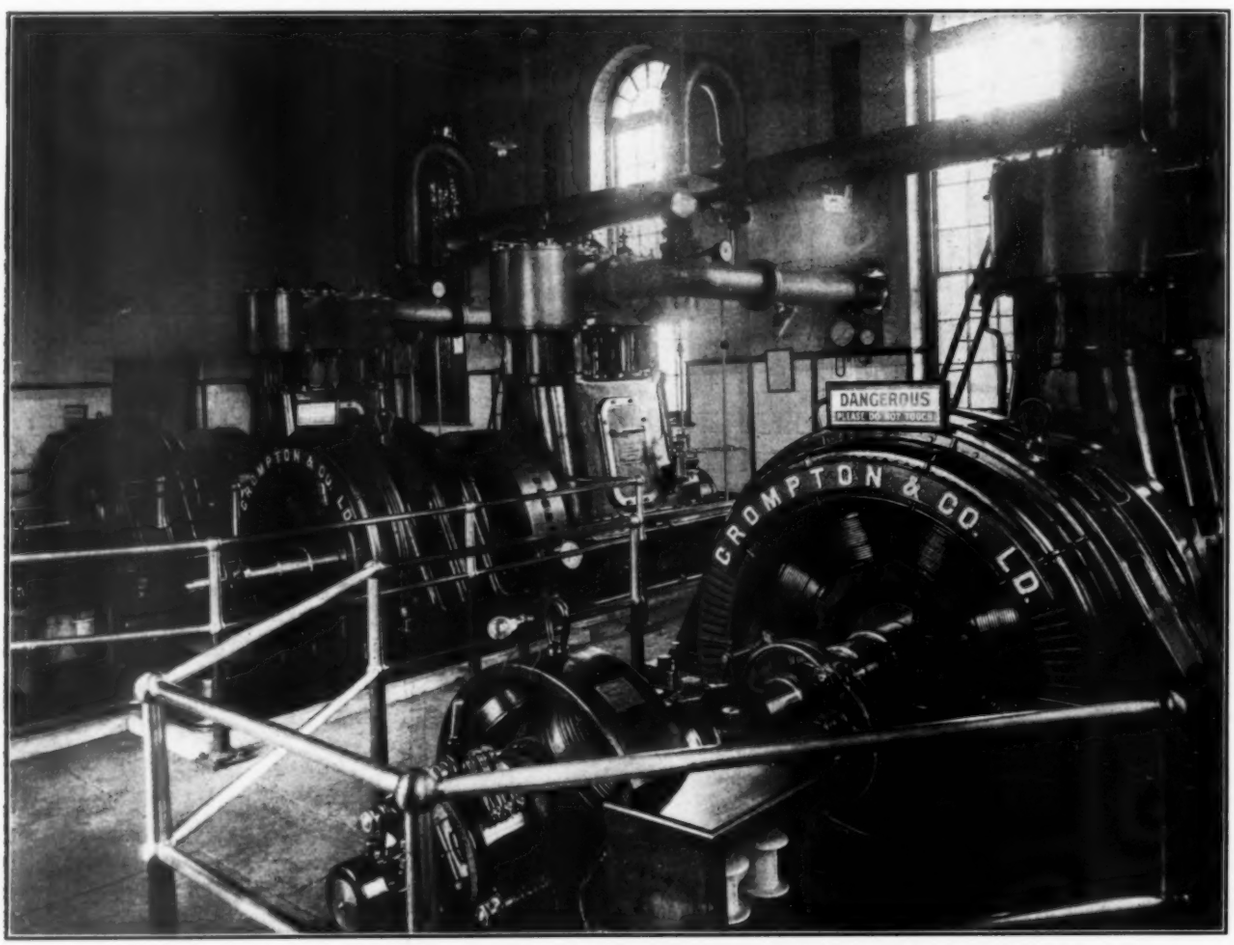
GENERATING STATION AT A WELSH COLLIERY.

When it is proposed to install electric machinery at a mine, the amount of power required, the hours during which it will be used, and other local conditions must be carefully considered in order to determine whether the necessary electrical energy shall be obtained from a power station specially installed at the mine, or from some outside source.

It is impossible to lay down a hard and fast rule as to the system of supply which should be utilized, as all mining operations are of such a nature that the machinery is often distributed over an extended area and sometimes at a considerable distance from the generating station or source of supply.

A high tension three-phase system is frequently found to be the most economical method of transmitting power to the various points at which it is required. There are, however, cases in which a supply at a lower pressure, employing either alternating or continuous current may be found advantageous, and each case, with the conditions governing it, must be carefully considered before this point is decided.

The accompanying illustration shows the generating station at the Mountain Ash Collieries of Nixon's Navigation Colliery Company, South Wales. The principal electrical equipment consists of the generating station, surface and underground mains, and a number of power motors. The engine house is close to the pit head, the shaft being 370 yards deep, and the motors in various positions are grouped round the foot of the shaft.



GENERATING STATION AT MOUNTAIN ASH COLLIERY, SOUTH WALES, GREAT BRITAIN.

The generating station contains three

steam alternators with engines by Belliss & Morcom, of Birmingham, England. They are two-crank compound engines working with steam at 150 pounds pressure, superheated 150 degrees, the steam exhausting into ejector condensers, the water for which is taken from an overhead tank containing a reserve of 40,000 gallons.

This tank is supplied from the river adjoining by two five-inch centrifugal pumps driven by twenty-three-brake-horsepower electric motors running at 1,450 revolutions a minute, taking their power from the main supply. Each engine drives a three-phase alternator with an output of 300 kilowatts at a speed of 375 revolutions a minute, a pressure of 550 volts between wires, and a frequency of twenty-five cycles per second, and the exciting current is in each case supplied by a small direct-current generator coupled to the engine shaft.

The electrical energy from the alternators is carried in cables laid underground to a conveniently situated switchboard gallery, on which are mounted three panels containing oil-break switches, overload and reverse-current circuit breakers, ammeters and voltmeters, fuses and exciter regulators, and a complete set of synchronizing gear; also four trunk feeder panels containing switches and fuses for the feeders and the usual earth-leakage indicators. From the engine house four trunk mains are laid underground, the cables being Messrs. Callender's one-quarter-square-inch, three-core conductors insulated with vulcanized bitumen and fiber and double-tape armored, supported in the trench. Dividing boxes are provided at the head of the shaft and eight cables taken down the shaft, each being a three-core cable 0.125 section, insulated with fiber and vulcanized bitumen, double-wire armored and supported in cleats with long glands at intervals of every forty yards in the shaft.

Near the foot of the shaft is a distributing board which has been erected in an old pump room and is kept locked. The board carries distributing fuses for eight circuits, a separate circuit being run from this point to each motor. The cables from the distributing board to the motors are of the same class as those in the shaft.

The motors are used for haulage and pumping. There are three 250-horsepower motors working main and tail gears for the principal roads. These are standard three-phase machines by Crompton and Company, Ltd. (London, England), and are fitted with round rotors and outside totally inclosed slip rings. They are direct-coupled to the gears and started, regulated and reversed by large controllers working in an oil bath. The whole of this plant is designed to deal with very heavy overloads, so that in the event of a fall or accident of any sort the electrical machinery would be the last part of the gear to suffer.

There are at present two pumps, built by the Uskside Engineering Company, erected in a new pump room on a lever level which has been very carefully designed and built and is lined with glazed bricks. It is in every way suited to the class of machinery in it, and contrasts most favorably with the pump houses in which electrical machinery has to be fixed in many collieries. Each of these pumps is capable of delivering 400 gallons of water per minute to a head of 1,500 feet and is driven by a 250-horsepower, three-phase motor running at 490 revolutions a minute, and similar in construction to those for the haulage gears.

There is also a single-lift winding gear in the staple pit driven by a seventy-five-horsepower motor and there are two blocking engine reversing gears each driven by a forty-horsepower motor.

The generating station, surface and underground mains, and motor equipment were carried out by Crompton and Company, of London, England.

Missouri Gas, Street Railway and Water Works Association.

The Missouri Electric, Gas, Street Railway and Water Works Association will hold its fourth annual convention at the Madison Hotel, Jefferson City, April 14, 15 and 16.

Among the papers to be read at this meeting is one on the luminous arc rectifier system, by Louis Friedman, and one by H. W. Clark on electrically-driven water works plants.

New Pacific Coast Power Company Stock.

At a special meeting of stockholders of the Pacific Coast Power Company in Seattle, Wash., it was voted to increase capital stock from $7,000,000 to $10,500,000, consisting of $1,500,000 preferred and $2,000,000 common. The purpose of the new issue is to provide funds for developing hydro-electric power on the White River.

THE 220-VOLT PROBLEM.[1]

BY GEORGE D. SHEPARDSON.

Engineers have recognized the desirability of using high voltage for the transmission and distribution of electrical energy. On transmission lines, the upper limit of voltage is determined by the increasing cost of transformers, poles and insulators and the greater loss by leakage and static discharge. On distribution lines, the upper limit of voltage is practically determined by consideration of public safety, as in the case of primary lines which are frequently limited by ordinance or by insurance requirements to 6,600 volts and more commonly to 2,500 volts. For general distribution and for use inside buildings, the highest practicable voltage is determined by the limitations of the receiving apparatus, such as incandescent lamps and other heating devices, and also by the requirements of the insurance rules. Both of these limitations are gradually rising, as a result of improvements in the manufacture and installation of wiring and of appliances. For use inside buildings, the National Electrical Code now allows as high as 550 volts for motors and some kinds of lighting, and as high as 300 volts for all kinds of lighting and other uses of electricity. Incandescent lamps, flat-irons, cooking and similar heating utensils are available for as high as 250 volts.

Statistics of a recent issue of the McGraw Central Station Directory, revised in some cases by other information, show that in 1909 there were 166 central stations in Minnesota, in which an aggregate capacity of 51,500 kilowatts is available for the 700,000 incandescent lamps connected. Of these thirty-five plants aggregating 25,000-kilowatt capacity and 179,000 connected lamps seem to be using three-wire secondary systems; seventeen plants aggregating 10,000-kilowatt capacity and 225,000 lamps use direct current three-wire sysems; a total of approximately fifty-two plants aggregating 35,000-kilowatt capacity with 404,000 connected lamps are using some sort of three-wire system (not necessarily including alternating current three-phase systems). Fifty stations aggregate about

1 Abstract of a paper read at the Minneapolis convention of the Minnesota Electrical Association, March 30.

11,000 kilowatts-capacity supply about 200,000 lamps with approximately 110 volts over two-wire circuits. Sixty-three stations aggregating 5,600-kilowatt capacity supply approximately 102,000 lamps at 220 volts over two-wire circuits. One small station apparently supplies 500 lamps connected to a 250-250-volt three-wire system. This thirty-eight per cent of the Minnesota central stations with 11 per cent of the total incandescent lamp capacity supply about 15 per cent of all the incandescent lamps lighted from central stations. The three-wire plants vary in size from twenty-five to 11,400-kilowatts capacity; the plants supplying current at 110 volts over two-wire lines vary in size from 17 to 1,000 kilowatts capacity; those supplying lamps at 220 volts vary from 15 to 400 kilowatts capacity. These comparative figures, which are approximately reliable, indicate that the special field for the 220-volt systems is in the small towns where the demand is limited and also scattered.

While the use of high voltages is generally desirable from the standpoint of the line, the consuming devices generally favor lower voltages. Generally speaking, motors, lamps cooking and other heating utensils cost more as the voltage rises. The efficiency of the various loads is apt to be practically constant, except that for very low voltages the large conductors are likely to involve increased loss of heat through the leading-in wires. The 220-volt incandescent lamp has always been inferior to the 110-volt lamp and is likely to continue under the double handicap of higher first cost and of lower efficiency in operation. In order to take the same energy at double the voltage, the current taken by the 220-volt lamp must be one-half that taken by the 110-volt lamp of equal rating; to take half the current at twice the voltage, means that the resistance of the 220-volt lamp must be four times that of the corresponding 110-volt lamp; this involves the use of a filament of half the area and twice the length. As the filament gets longer and of smaller area it becomes mechanically weaker and it cannot be operated safely at so high a temperature; it should be supported at more frequent points than required by the larger filaments. On account of the necessity for high resistance, the carbon filament lamp has not been developed so far as has the 110-volt lamp. The 220-volt carbon-filament lamp still uses a filament which is neither flashed nor metalized. For many years the filaments of 110-volt lamps have consisted of a central core of carbonized cellulose upon which a coating of graphite has been "flashed" by heating the base filament to incandescence in an atmosphere of some hydrocarbon such as gasoline or turpentine vapor, the heat causing the vapor to dissociate and to deposit pure graphite carbon on the heated filament.

After the development of the tantalum lamp which made 2.0 watts per candle commercially possible for the 110-volt lamp, a special 220-volt tantalum lamp was developed, having two-volt filaments connected in series. This required a much longer globe and was feasible only for lamps of twenty-five or more candlepower. The development of the tungsten lamp with an efficiency of 1.25 watts per candle for 110-volt lamps, was soon followed by the "Mazda" lamp having efficiencies varying from 1.15 watts per candle for 250-watt lamps to 1.33 watts per candle for twenty-five-watt lamps.

While the 220-volt lamp costs more to buy and more to operate than does the 110-volt lamp, and while the arc lamp problem is much more troublesome, yet there are certain redeeming features which make the 220-volt system give satisfactory service and earn satisfactory dividends. The simplicity and the lack of difficulties from low power factor and from induction troubles enable an engineer of ordinary ability to handle a 220-volt direct current system with less trouble and uncertainty than he could handle an alternating current system. The lower voltage and the absence of transformers and their exciting current, should bring about higher efficiency of the distributing system, so that the ratio of the total watt-hours sold, to the total watt-hours generated at the station should be considerably higher for the 220-volt direct current system than for the alternating current system. On the other hand, the direct current watt-hour meter is apt to be more expensive and more likely to run slow with age than is the lighter induction meter used for alternating currents. Another item that lessens the relative disadvantage of the 220-volt system is the fact that the smallest size wire allowable on pole lines is governed not by minimum allowable electrical conductivity, but by its mechanical strength. In general, the 220-volt lamp is advantageous even to the ultimate consumer. For with him, it is likely to be a question as to whether he can have any electric light at all if he is not supplied at 220-volts, for in many small and scattered towns a 220-volt system is the only electric system that would pay. He therefore has the choice not between 110-volt and 220-volt lamps, but between electric 220-volt lamps and "electric" oil lamps. It may therefore be concluded that the 220-volt system is desirable in many cases where the loads are small and are scattered and where the total load is comparatively small. As the country becomes more highly developed and as high tension lines are multiplied, larger and larger districts are likely to be served from central power houses generating alternating currents and distributing power over a radius of twenty to one hundred miles.

Boiler Explosions.

The following table of boiler explosions, summarizing the records of the accidents in this country from the year 1886 to 1909, inclusive, and which was published by the Hartford Steam Boiler Inspection and Insurance Company (of Hart, Conn.) in a recent issue of its publication *The Locomotive*, affords some interesting reading.

SUMMARY OF BOILER EXPLOSIONS, FROM 1886 TO 1909 INCLUSIVE.

Year.	Number of Explosions.	Persons Killed.	Persons Injured.	Total of Killed and Injured.
1886	185	254	314	568
1887	198	264	388	652
1888	246	331	505	836
1889	180	304	433	737
1890	226	244	351	595
1891	257	263	371	634
1892	269	298	442	740
1893	316	327	385	712
1894	362	331	472	803
1895	355	374	519	893
1896	346	382	529	911
1897	369	398	528	926
1898	383	324	577	901
1899	383	298	456	754
1900	373	268	520	788
1901	423	312	646	958
1902	391	304	529	833
1903	383	293	522	815
1904	391	220	394	614
1905	450	383	585	968
1906	431	235	467	702
1907	471	300	420	720
1908	470	281	531	812
1909	550	227	422	649

The Railroad Commission of Indiana has issued a bulletin commenting on the effect of its order of 1908 directing railway companies to erect crossing signs. There has been a considerable decrease in the number of crossing accidents, which the commission attributes to the erection of these signs.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

ELECTRIC CAR LIGHTING.[1]—II.

BY J. R. SLOAN.

The third system mentioned—the axle generator system—consists essentially of a generator driven in some manner from the car axle, a set of batteries and the necessary mechanism for the regulation of the axle generator. Within the last few years there has been added to these a lamp-voltage regulator.

Cars equipped with axle generators are subject in a much less degree to the limitations in regard to service, that obtain with the two previous mentioned systems.

Each car is an independent unit, carrying its own source of power, and therefore, requires ordinarily a very much shorter layover, much less yard wiring at terminals, interferes less with the work of the yard master, and the engine crew en route is powerless to interfere with its operation.

The system, however, is not without its drawbacks, which are as follows: (1) Difficulty in transmitting power from the car axle to the armature shaft where the drive is between very short centers and is exposed to all conditions of weather, snow, ice, etc., flooded from track tanks, and bombarded with ballast. (2) The great range of speed through which the generator must adjust itself automatically and the use of the regulating mechanism that is thereby entailed.

The first axle generators were known as the constant-current type, *i. e.*, the generator for a given setting delivered the same number of amperes at all times, rgardless of the necessities of the case, although by changing the setting the number of amperes delivered could be varied.

The batteries and lamps were connected in multiple across the battery and to compensate for the difference between the charging voltage of the battery and the lamp voltage, or average voltage of the battery on discharge, a fixed resistance was introduced in the lamp circuit as the generator cut in, to protect the lamps.

In consequence of the constant-current feature it was necessary to adjust the output of the generator to the conditions of the run, so that taking the the run as a whole the battery would receive the proper amount of charging. If the car was changed to a different run, the setting also had to be changed.

One of the great objections to this type of generator was the poor voltage regulation on the lamps. For instance, if the battery were in a discharged condition, it would require less than normal voltage, for which the lamp resistance was calculated, to produce the predetermined current and consequently the lamps would burn below candlepower, while if the batteries were fully charged, the reverse would be the case.

In order to guard against failure of lights it was common practice to set the output of the generator at a value in excess of the actual requirements of the run, with the consequence that the batteries were overcharged, and the resulting evolution of gas blew out the active material and decreased the life of the battery.

Later, the constant-current system was modified by introducing a differential winding in the regulating solenoid, which carried the lamp current, causing the generator to pick up more or less of the lamp load, in addition to the battery load, depending on the effective number of turns in this differential solenoid winding. This was an improvement, but overcame the overcharging of the battery only in part, and, to a less degree, the poor regulation of the lamp voltage.

Since these early machines, great improvements have been made, and what is now demanded by the railroad companies is a generator and regulating apparatus that will accomplish the following: (1) Charge the battery at its normal rate until a certain predetermined terminal charging voltage is attained. When this voltage is attained the charging current is to be tapered off, until it falls to practically zero value, or the charging current is practically discontinued and the battery floats, neither charging nor discharging. (2) The lamp load should be picked up entirely independently of the battery load. (3) The lamp voltage should be maintained practically constant, regardless as to whether the generator is operating and supplying current to the lamps, or whether the battery is discharging and supplying this current. (4) That the "cutting in" speed should not exceed twenty miles per hour, and that from this speed to eighty miles per hour the apparatus will perform as above. (5) That all coils should be constructed so as to be heat, oil and moisture-proof.

It is believed that if sufficiently rigid specifications be drawn covering the above points, and also covering heating, voltage, and insulation tests, and workmanship and material, that axle generators could be obtained that would give satisfactory service in operation, and it is further believed that generators now on the market would fulfill such specifications.

One of the greatest troubles with the operation of axle generators is the drive. Axles are either hammered or rough-turned, and in both cases are tapered, the smaller diameter being at the center of the axle, and as the pulley is generally placed to one side of the center of the axle, this makes it difficult properly to secure the pulley.

The common means of transmitting the power is by belt, generally by the so-called "rubber" belt. With this type of belt it is extremely difficult to join the two ends of the belt so that the joint will have a tensile strength approximating the tensile strength of the belt itself. In other words, the joint is the weak spot in the belt, and the belt is lost by this joint failing. It is an extremely rare case to have a belt actually worn out in service.

Experiments are being made using

1 Abstract of a paper read before the Central Railway Club, New York City, March 11, 1910.

the Morse chain, and also a standard automobile chain. The objection to these chains is their comparatively great first cost, to which must be added the cost of the two sprockets, as they wear out about as fast as the chain. Greater mileage, however, has been attained by the use of chains than with belts, and the experience to date indicates that there is a possibility that this form of drive may ultimately be successful.

In the past very little attention was given to equipping the car with lamps and fixtures which would give the best results from the illuminating standpoint—that is, taking into account not only the light produced, but also its effect on the eye. Some work has been done lately along these lines, but much remains to be done.

In the opinion of the writer the day will soon arrive when all steam equipment operated in passenger service will be electrically lighted, and that the great majority of the lighting will be done by axle generators, although the head end and straight storage systems will still be used when the conditions are such as to make them applicable.

New York Section of the Illuminating Engineering Society.

The April meeting of the New York Section, Illuminating Engineering Society, will be held on the evening of Thursday, April 14, in the regular meeting hall in the United Engineering Society's Building, twenty-nine West Thirty-Ninth Street, New York.

The papers of the evening will be "The Relationship of Fixture Design to the Illuminating Engineering Practice," by L. R. Hopton and H. E. Watkins, and "On Finite Surface Sources," by Bassett Jones, Jr.

Race on Tunnel Engines.

The Pennsylvania Railroad shops are working on forty-two new electric locomotives for use in the Hudson River tunnels, as traffic conditions demand their services at as early a date as possible. The trucks are being built at the Juniata shops, while the cabs are being turned out at the car shops, and the keen rivalry between the two departments has resulted in the machines being completed at the rate of six a week. They are then sent to the Westinghouse Electric Company at East Pittsburg to be electrically equipped.

Modern House Lighting with Low Voltage.

The subject of lighting houses by current low voltage is one which has occasioned much notice of late, and therefore the following article by E. B. Walker, which is taken from the March issue of our contemporary, the *Canadian Electrical News*, will prove of interest.

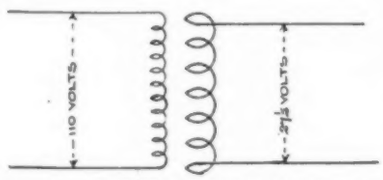


FIG. 1.—ORDINARY DOUBLE-WOUND TRANSFORMER.

Although the tungsten lamp has almost replaced the carbon lamp for the lighting of stores and large buildings, it has not so far had extensive use in Canada for lighting the ordinary dwelling, chiefly on account of its high candlepower and its fragility, especially in the small sizes.

An ordinary room does not require large units of light, and it may be generally said that a number of small units distributed carefully, will give a more pleasing and artistic effect, besides being much better for the eyesight. Hallways, too, should be kept lighted during the evening by a few low-candlepower units, but with a five-candlepower twenty-watt carbon lamp this hall lighting will mean an important addition to the monthly bill. The 100 to 130-volt tungsten lamp has offered little assistance to the ordinary house, as the smallest unit is about eighteen watts, and therefore is useful only in the larger rooms, beside being rather too fragile to be used in a key

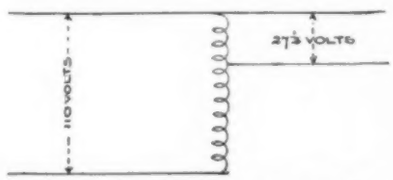


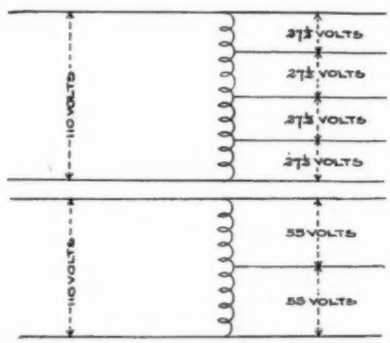
FIG. 2.—SINGLE-WOUND AUTO-TRANSFORMER.

socket or wall bracket where it is apt to be subjected to occasional vibrations, which go far to shorten its life.

The low-voltage tungsten lamp offers a solution to these difficulties, and wherever alternating current is available, as is the case in most of our towns, it can be conveniently and cheaply used by means of a small transformer designed especially for low no-load losses.

Lamps.—The lamps are made for twenty-five to thirty volts and can be obtained in the following sizes: Eight, ten, twelve, fifteen, twenty, twenty-five, thirty, and thirty-five watts. Wherever a large number of lights are to be supplied, and perhaps high candlepowers desired, it will be preferable to use the fifty to fifty-five,volt type, obtainable in ten, twelve, fifteen, twenty, twenty-five, thirty, thirty-five, forty, fifty and sixty-watt sizes.

Lamps of the twenty-five-volt class have filaments about one-quarter of the length of those of the 110-volt sizes, and the eight-watt filament is about the same thickness as the thirty-five-watt, 110-volt. Owing to these stout, short filaments, the lamp is very much stronger, and, in fact, may be safely used in desk lamps and other portables.



FIGS. 3 AND 4.—BALANCING TRANSFORMERS.

It has been thoroughly demonstrated that these lamps have a much longer life than the 110-volt class, the average being about 3,000 hours for lamps in stationary fixtures, and even in railway car lighting, where they have extensive use, the average life is about 2,000 hours.

Transformers.—The transformers for use with these lamps can be supplied for any voltage and frequency, and may be roughly divided into three styles of winding: (1) The ordinary double-wound transformer, Fig. 1. (2) The single-wound auto-transformer, Fig. 2. (3) The balancing transformer, Figs. 3 and 4.

The first type is recommended wherever the house wiring is not up to the present standard of insulation, as the lamp circuit is completely insulated from the line and the maximum voltage on the wiring is only twenty-five to thirty volts. Where old wiring has been condemned it would often be satis-

factory and certainly much cheaper to use this type of transformer than to go to the expense and trouble of having the old wires torn out and new replaced.

This type has also extensive use in England in connection with a cheap form of exposed wiring where flexible cord armored with braided tinned copper wire is used, the armor forming one side of the circuit.

The second type is recommended for all ordinary installations up to about fifty ten-candlepower lights.

The third type is suitable for larger installations, as it has the advantage that only the out-of-balance current must be taken care of, and as long as this does not exceed the capacity of the transformer, the number of lamps is only limited by the capacity of the supply mains.

The standard transformer has a ratio of 4 to 1, and as the prevailing voltage in Canada is 110, the lamps should be about twenty-seven volts, allowing one-half volt for line drop. Of course,

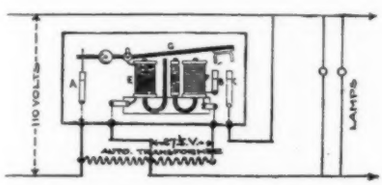


FIG. 5.—AUTOMATIC TRANSFORMER SWITCH.

the winding can be arranged for any voltage, but the 4 to 1 ratio has the advantage that it divides up in four equal circuits in the case of a balancing transformer, and consequently twenty-seven-volt lamps will suit either type.

In many cases these transformers are provided with taps for 105, 110 and 115-volt primaries, allowing adjustment to suit local conditions.

In using one of these transformers, there is a small but continuous consumption of current due to the transformer core losses. This amounts to from five watts up, and is sufficient to add considerably to the monthly bill. Of course, the transformer can be switched off during the day, but this would be rather troublesome, and on this account the automatic transformer switch has been developed, Fig. 5.

While this switch costs as much, and sometimes more, than the transformer, it is well worth the extra expense, as a continual loss of five watts would cost about $4.38 per year at ten cents per kilowatt-hour.

On no load the windings of the automatic transformer switch are disconnected from the mains by the rocking armature *G* (Fig. 5), which is weighted at one end. When a lamp is turned on, current passes from one of the mains through the lamp to the common terminal of the transformer, and by way of the windings on the pull-on magnet *E*, the armature *G* and the mercury cup *A* to the other main. The magnet *E* becomes energized, pulls down *G* and makes contact with the hold-on magnets *D* and *F*, and with mercury cups *B* and *C*, at the same time breaking contact in the mercury cup *A*.

As an example of the saving effected by the use of this system in a small house, we give the following:

A house wired for twenty-five lights, and an average consumption of ten ten-candlepower lamps or their equivalent for three hours per night is assumed:

CARBON LAMPS.	
First cost, twenty-five carbon lamps at twenty cents each	$ 5.000
Monthly operating costs: Ten lights at thirty-five watts for three hours per night, thirty nights per month =31,500 watt-hours, at ten cents per kilowatt-hour	3.150
LOW-VOLTAGE TUNGSTEN LAMPS.	
First cost, twenty-five twenty-seven-volt tungsten lamps with transformer and automatic switch	35.000
Monthly operating cost: Ten lights at twelve watts for three hours per night, thirty nights per month= 10,500 watt-hours; at ten cents per kilowatt-hour	1.050
Transformer core loss = 450 watt hours	.045
Renewals, 900 lamp-hours per month, at .025 cents per lamp-hour	.225
Total monthly cost	$ 1.320

Saving per month=$3.15—$1.32=$1.83.
Difference in first cost=$35.00—$5.00=$30.00.
Or excess first cost of tungsten system is paid for in about 30/1.83, or 16.4 months.

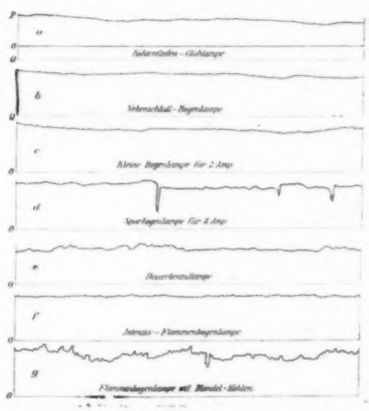
After the equipment has been paid for in economy of current, the saving over the carbon system is in the proportion of same light for two-fifths of the cost.

In the case of 200 to 250-volt circuits with the accompanying drawbacks of lower efficiencies and no small candlepower carbon units, the saving is, of course, even more marked.

Although there is a constantly increasing demand for tungsten both in the steel and electric light industries the United States produced only 671 short tons of it last year, as against 1,640 tons the year before.

Comparative Tests of the Light Variations of Different Arc Lamps.

In judging the construction of an arc lamp or the quality of a brand of carbons the observation of the light variations is of essential importance, for the intensity and steadiness of the light are undoubtedly deciding factors in the practical applicability of the lamp. While numerous arrangements are in use for measuring light intensity, the variations of the light furnished by a lamp are usually determined by mere observation, without the aid of any instruments, which is a most unreliable process. Ernest Presser describes a method which permits the automatic registration of the light intensity of any source of light by very



CURVES OF LIGHT VARIATION.

a Carbon incandescent lamp; *b* shunt arc lamp; *c* arc lamp for two amperes; *d* Economy arc lamp for eight amperes; *e* long-burning arc lamp; *f* flaming arc lamp; *g* flaming arc lamp with Blondel carbons.

simple means. It is based on the sensitiveness of solenium to light; that is, the property of any one of several modifications of this element to decrease its electrical resistance under the influence of light rays, and immediately to increase it again upon the cessation of the influence. Werner von Siemens and others have proposed a solenium photometer, but there are many difficulties in the way of measuring the intensity of a source of light in units in this manner. Quite different conditions exist when it is a question of observing the variations in the intensity of a source of light, for in this case only the deviations of the light intensity from a mean value are to be determined in per cents. In the experimental arrangement a solenium cell illuminated by the source of light to be observed is connected in series with a continuously registering milliamperometer. If care has been taken to

avoid great temperature changes in the selenium cell during the test and the cell is sufficiently free of sluggishness, which condition may be attained by suitable construction, the registering instrument will furnish a curve that reproduces the light variations. It is assumed that the tension at the selenium cell is maintained as constant as possible. The diagram shows curves that have been produced by this method. —*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), February 24.*

The Resistance and Reactance of Armored Cables.

It has been asserted frequently that no form of iron protective covering is permissible for single conductors carrying alternating currents. Experience and simple calculation show this assertion to be well-founded with regard to even the thinnest walls which form a completely closed magnetic circuit about the conductor according to the results obtained in the physical laboratory of John Hopkins University and published in a recently issued circular. It states further that these facts have caused a hesitation in the use of single conductor power cables in which the armor consists of a number of iron wires spiraled about the lead covering of the cable. It is evident that the reluctance of the magnetic circuit so formed must be far less than that of a closed magnetic circuit of uniform section and without air gaps.

The value of this reluctance has been calculated for a range conforming to the number and size of armor wires met in practice, and the result indicates that the reactance of the usual type of single conductor, iron-armored power cable may be from two to four times that of the unarmored cable depending on the distance to the return conductor; the factor increases with decreasing distance.

Following these calculations measurements were made on several cables of varying characteristics. The results show that in cables as manufactured the reactance is about 0.7 of the maximum theoretical value. The effective resistance as measured varies little with the distance to return conductor and is about 1.6 and two times the dead resistance at twenty-five and sixty cycles respectively and at current densities conforming to good practice in the type of cable. The calculations and results of experiment indicate that the use of this type of cable is not prohibited by the values of reactance and losses in armor.

Hydroelectric Power Development in Russia.

In the March *Proceedings* of the American Institute of Electrical Engineers, there appears the following item which should prove of interest to electrical men in this country:

As a result of the development and successful operation of high-tension transmission lines in the United States, interest in electrical engineering progress in this country is rapidly growing in Russia. This has been stimulated by the recent investigations of Prof. H. J. Ryan and Ralph D. Mershon. The Ministry of Ways and Communication at St. Petersburg, Russia, has become interested in a scheme of hydroelectric power transmission which will involve the electrification of suburban divisions of the state railroads, and the subject is now under consideration. As some doubt seemed to exist in the minds of some of the officials as to the reliability of a 100,000-volt transmission line as compared with a 60,000-volt line, the latter being the highest in use in Europe, telegraphic inquiries have been made of some of the leading men in the electrical engineering profession in America as to the comparative merits and reliability of the two lines. Prof. M. A. de Chetelain, of St. Petersburg, one of the most enthusiastic exponents of hydroelectric development in Russia, has been invited to make a demonstration of some high-tension transmission experiments with new types of insulators and different sizes of conductors before the officials interested. The advance of electrical engineering in Russia is likely to open a new and extensive field to American engineers.

Electrical Exports for January.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has completed its monthly summary of exports and imports of the United States for the month of January. From this the following relative to the electrical exports from this country during January are taken.

As compared with conditions last year the figures indicated that the year of 1910 will greatly surpass that of any previous one in point of exports.

To give an idea of the steady gain being made over last year the following figures giving the total electrical exports for the seven months ending with January in both cases are of interest: 1909, $6,940,836; 1910, $7,678,142.

The comparatively monthly data are as follows:

	1910	1909
Electrical appliances	$621 465	$500,309
Machinery	565,838	452,851
Total	$1,187,307	$953,160

The principal countries to which electrical products were shipped from the United States during January, with the values of these exports, are as follows:

	—Electrical—	
Exported to—	Appliances	Machinery
United Kingdom	$ 33,981	$ 27,940
Belgium	6,078	.....
France	2,976	18,776
Germany	6,711	5,257
Other Europe	6,051	18,567
British North America	174,781	77,651
Central American States and British Honduras	35,948	14,754
Mexico	78,290	109,794
Cuba	57,061	57,814
Other West Indies and Bermuda	13,243	5,223
Argentina	17,232	1,261
Brazil	91,855	47,167
Other South America	20,397	5,114
Japan	28,359	87,928
British Australasia	18,805	28,226
Philippine Islands	20,445	13,793
British Africa	2,650	10,802
Other countries	6,606	.....

To Transfer Power Sites to States.

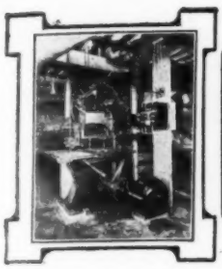
A bill has been introduced in the United States Senate by Senator Smoot, providing for the transfer of water-power sites from the National Government to the several States and Territories in which they are located.

Contrary to the general expectation the bill provides for the leasing of power sites by the States, but does not permit the sale of the property under any conditions. The transfer of the land to the State is permitted only when the Secretary of the Interior shows that the property is chiefly of value as a power site. The transfer must not interfere with prospecting or the development of mineral resources.

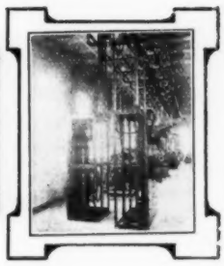
Other conditions of the bill are: That the land shall be devoted by the lessee only to the development of water-power; that the State shall reserve the right to fix charges by power companies for each ten-year period; that no monopoly shall be permitted to lessees under law. The last section would provide for the forfeiture of the land by the States in case of any disposition of the land contrary to the provisions of the proposed law.

Ohio Public Utilities Bill.

The Woods substitute Public Utilities bill providing for a commission to supervise the public franchises of the state of Ohio passed the House by a vote of ninety to seventeen.



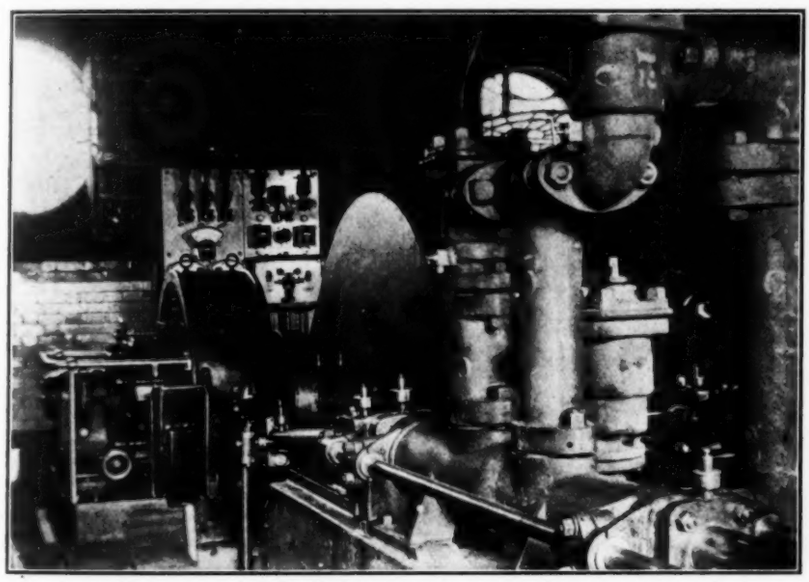
Industrial Power



AN ELECTROHYDRAULIC PUMPING PLANT.[1]—I.

BY W. A. CLATWORTHY.

There are a good many hydraulic pumps driven by electricity at the present time, various methods of control being adopted, and a paper describing the different systems would no doubt be of great interest. The plant about to be described, however, has, I believe, many points of interest, besides some features which are novel, particularly in the method of electrical control. The object of the plant is to provide water power for operating various cranes, capstans, lock gates, bridges, etc., in connection with the docks at Bristol, England.



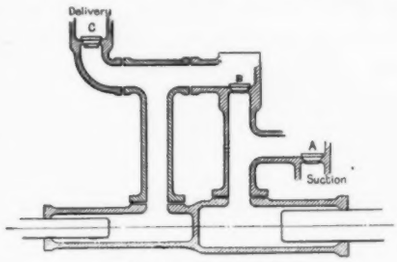
VIEW OF ONE OF THE PLANTS AND PORTION OF SWITCHBOARD.

Until quite recently this work has been done by two sets of heavy steam reciprocating pumps, automatically controlled in the usual well-known way by the movement of the accumulator.

There were several reasons for the substitution of electrical driving, amongst which may be mentioned that the boilers were becoming "done," that the Bristol Corporation was supplying electric current at favorable rates, and not least, on account of the high efficiency obtained in electric motor driving. There was space in the pump room for three steam sets, but only two were installed, one at each end of the room. It was therefore decided to fix the first electrically driven set in the central position between the two steam sets. The foundations were of very massive concrete, room being left at the side and below the floor level for the jack pumps, which were driven from the extension of crank disk pins through connecting rods.

When this central set of electric pumps had been installed and satisfactorily set to work, one of the steam sets was removed, fresh concrete foundations being prepared for the second electrical set of pumps, which was next installed. Finally, the second set of steam pumps was removed and the third electrical set put in its place, but on new foundations.

Pumps.—The new pumps, which were to the specification of W. W. Squire, the Bristol Docks engineer, and which were made by the well-known firm of engineers, Fullerton, Hodgart & Barclay, Paisley, Scotland, are of the duplex differential ram type, giving a very uniform delivery of water and having a fairly uniform turning effort. The pumps are of the outside packed plunger type, each pump being single-acting on the suction and giving a double-acting discharge. Each set of pumps really comprises two pumps working from cranks set at right angles. The rams are three and five-eighths inches and five and one-eighth inches respectively by eighteen-inch stroke, delivering 150 gallons of water per minute, against an accumulator pressure of 750 pounds per square inch when running at sixty revolutions per minute. The suction pipe for each set is six-inch diameter, branching to five-inch diameter at each pump suction valve box. The delivery pipe is four-inch diameter from each pump, coupled to a four-inch pipe joining the main discharge pipe.



SECTION OF PUMP.

The ram of the jack pump is seven and one-half-inch diameter by eighteen-inch stroke single-acting, delivering not less than 27.6 cubic feet of water per minute against a head of fifteen feet, and drawing from the dock with a suction head of five feet at sixty revolutions per minute. The large ram draws water through the double suction valve *A* (seen in the accompanying illustration), and on the return stroke discharges it, the whole of the water, through valve *B*. Half of this water passes to the small ram filling the chamber, as the small ram travels on its out-

1 From a paper delivered before the Newcastle (Eng.) Section of the Institution of Electrical Engineers.

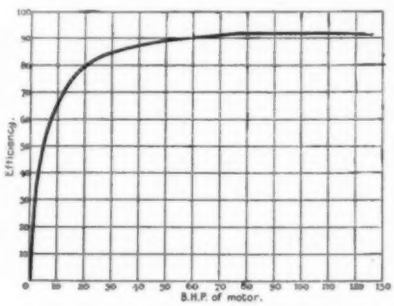
ward stroke, the other half passing through the non-return valve *C* away to the hydraulic main. On the reverse stroke the small ram discharges through the non-return valve *C*, while the large ram is again drawing its supply through the double suction valve *A*. This arrangement simplifies the number of valves required and yet retains a uniform load on both rams. Half the area of the large ram is under full pressure when pumping, the smaller one being always under constant pressure. An equally steady flow of water could be obtained with both rams of the same diameter, but this would entail separate suction and delivery valves for each ram.

Motors.—The motors are by J. H. Holmes and Company, of Newcastle-on-Tyne, six-pole, open type, with three bearings, designed for a normal speed of 240 revolutions per minute, 500 volts, but arranged to run up to a maximum speed of 360 revolutions by means of field regulation. The motors are shunt-wound and capable of easily giving 125 brake horsepower normally and 150 brake horsepower as an overload. The efficiency is ninety-one per cent, giving a fairly straight "curve" over a good range of load.

Gear.—A single reduction of machine-cut double helical gear is used between each motor and set of pumps, with a ratio of 1:6—*i. e.*, twelve-inch pinion and seventy-two-inch wheel; the teeth are staggered. This gear is of great strength and very smooth in running. The wheels run in an entirely inclosed cast-iron casing forming an oil bath, inspection doors being provided.

Control.—The whole of the switching apparatus was made by J .H. Holmes and Company, consisting of a switchboard in the pump house, and of three relay switches in the accumulator house. The switchboard consists of four white marble panels. One of these carries the ammeter circuit breakers, fuses, etc., and the remaining three carry the motor-controlling devices.

The starting switch is of the long-screw type with about fifty to sixty contacts, each contact consisting of a permanent gun-metal base bolted to the marble slab, and on which a renewable copper bar is screwed. The sweating sockets at the ends of the insulated cables from the resistances are bolted to the contact bases. The sliding contacts, four abreast, any one of which can be instantly removed, are carried from a traveling bridge worked up and down by the screw. The screw is of fairly large diameter, with a quick thread, and runs in ball bearings. The screw is rotated by a small reversible Lundell motor through triple-threaded worm gear, a regulating switch being provided for adjusting the speed of starting the pumps. The usual time occupied is fifteen to sixteen seconds, but the return of the starter is quicker. The screw starter contains a lever switch which is closed mechanically by means of a tappet operated from the traveling bridge. This lever is held on magnetically, thus providing a no-voltage release in the event of the supply failing. A relay circuit is made by this lever in its "off" position so that the starter is automatically returned to its initial position on the resumption of the current supply. The pilot motor circuit is taken from the neutral wire to the negative main, 250 volts. This pilot circuit is kept quite distinct from the



EFFICIENCY CURVE OF MOTOR.

main circuit, and has its own double-pole fuses, and no-volt release double-pole switches. The field regulating switches for the pump motors are fixed at the tops of the panels, and are of the solenoid type with oil dashpots for retarding the motion both in raising and lowering the speed. There is no permanent step for speed regulation between 240 and 360 revolutions. The point where this increase of speed shall take place is, of course, determined by the movement of the accumulator, but the screw starter is provided with special contacts in its full "on" position which prevents the field regulating switch from rising until all the starting resistance has been cut out, and thus insuring that the motors shall start with full field strength, no matter how rapidly the accumulator may be falling.

The pilot motor which operates the starter is controlled in both directions of rotation by small solenoid switches without the use of starting resistances, the connections thus being very rapid. There are two of these solenoid switches, one for starting up and the other for returning the starter to its initial position. They are electrically interlocked so that one can operate at a time.

Owing to the limited capacity of the transforming station from which the current supply was drawn, it was necessary to provide that not more than one set of pumps should start at a time. This could not conveniently be arranged from the accumulator switches, because at times the demand for power was so large and the fall of the accumulator so rapid that otherwise it would have been impossible to prevent a second set of pumps starting before a first set had been fully started. Special contacts, therefore, were placed at the ends of the starters to provide for this and in the relay circuit of the solenoid switches belonging to the pilot motor.

As a general rule two sets of pumps deal with the load satisfactorily, and although the plant thereby has practically a spare set of pumps, yet all three sets are kept in working order, and do their share of the load in turns. A three-point, six-way grouping switch is mounted on the switchboard so that the following combinations are possible:

(*a*) Sets 1 and 2 connected up, No. 1 starts first.
(*b*) Sets 2 and 3 connected up, No. 2 starts first.
(*c*) Sets 1 and 3 connected up, No. 3 starts first.
(*d*) Sets 1, 2 and 3 connected up, No. 1 starts first.

(To be continued.)

A Long Trolley Trip.

What will be the longest trolley trip on record ever made will begin at Utica, N. Y., about April 15, the ultimate destination being Indianapolis, Cincinnati and Louisville, while Toledo will be included in the itinerary. The trolley party will include members of the Utica board of commerce, and will be in charge of C. Loomis Allen. The purpose of the trip is to boom Utica.

In the run from Toledo to Detroit the party will use the Detroit, Monroe & Toledo Short Line, and according to advices received by that road, the trip will be made in two private cars, which will cover a total distance of 2,049 miles, and the running time will be eighty-one hours and forty-eight minutes.

Brush Discharge Losses.

A paper on "Losses Off Transmission Lines Due to Brush Discharge with Special Reference to the Case of Direct Current," was presented by E. A. Watson on February 14 last before a meeting of the Institution of Electrical Engineers in London, England.

The author's introduction to the subject is as follows:

"Leaving aside economical considerations, there are three factors which may be said to limit the voltage which can be employed on a transmission line. These are: (1) The generating or transforming apparatus. (2) The line insulators. (3) Brush discharge off the line itself.

"Of these it may safely be said that the third is the only one which will ultimately need to be considered, and is, at the present time, of considerable importance. The limits imposed by (1) and (2) are chiefly a matter of design, requiring, of course, a large amount of experience, but none the less capable of considerable expansion above the values at present customary.

"The use of oil insulation for transformers and switches, the introduction of 'condenser-type' terminals for bringing out leads from apparatus, and the new and rapidly growing use of 'suspension-type' insulators for the overhead line, seem to indicate that on neither of these scores is it possible to say that any definite voltage has been reached beyond which it is impossible to go.

"With the third factor, however, it seems to be otherwise, and since it is beyond our power to increase the insulating power of air, unless there takes place a considerable change in the present practice of line construction, there will always be some voltage limit which it is not possible to exceed.

"The question as to whether a discharge will take place off a wire or not seems to depend upon the value of the electric stress in the immediate neighborhood of the wire. If this stress should exceed the electric strength of the air in which the wire is immersed, a discharge will occur. If the wire is sufficiently close to the other boundary of the field of force which produces the stress the discharge will be actually disruptive, such as is given by a spark or arc; in the case of a transmission wire, however, this is not the case, and the discharge takes the form of a luminous envelope surrounding the wire, and is generally known as the corona. It produces a slight noise, and although only faintly luminous to the eye, gives off a powerfully actinic light, and can be readily photographed."

A discussion on previous work done upon the subject of the corona follows, after which is given an account of the author's researches. His conclusions, in the form of a "general summary," are given below:

1. There is a definite critical stress for which loss occurs from a direct-current line just as for an alternating-current one.

2. The direct-current stress required to produce this loss is the same as the maximum alternating-current one.

3. This stress is substantially the same whether the wire is positive or negative provided that it is clean.

4. For dirty wires the electric stress is lowered much more for negative than for positive charges.

5. The critical stress is greater the smaller the wire diameter.

6. The critical stress is reduced by reduction of the air pressure but not proportionately.

7. The presence of water vapor in the air does not affect the loss or critical stress for a clean wire.

8. An actual transmission line does not behave exactly like a perfectly clean wire, but that a factor of safety varying from 1.5 to two should be allowed. This factor probably depends somewhat on the conditions of the district in which the wire is situated and is probably less for a line in a clean mountainous region than for one in an industrial district. The loss is also affected by the presence of water vapor in the atmosphere especially for low values of the electric stress, and a considerable loss takes place before the wire is uniformly enveloped in a corona or becomes noticeably luminous.

9. The loss which occurs with direct current when the critical stress is exceeded is due to the production of gaseous ions at the surface of the wire.

10. The actual current lost depends partly upon the amount by which the stress at the wire exceeds the critical value and partly upon the disposition of the wires.

11. With alternating-current lines part of the loss may be due to the energy stored in the layers of air surrounding the wire and which upon breakdown becomes converted into heat, but this is insufficient to account for the whole loss which is observed and part of the loss is probably due to the same cause as that for direct currents.

In the discussion that followed H. M. Hobart called attention to the fact that two previous speakers, E. H. Raymer and Dr. Alexander Russell, agreed with Mr. Watson in putting the proportionate pressure limits of direct current and alternating current at 140 and 100 respectively for the same mechanical conditions, whereas when the Thury system was discussed before the Institute an advantage of nine to four was claimed in favor of direct current, which was evidently wrong.

A Wind-Operated Electric Plant.

The *Detroit Free Press* records an instance of enterprise on the part of an Illinois farmer, who, with little or no electrical knowledge, has equipped a wind-operated electric plant on his farm for information gleaned by reading an article on the subject in a technical magazine.

The complete windmill plant on this model farm consists of a small storage battery, an electrical generator for charging the battery, a windmill for driving the generator and an automatic device for controlling the current to and from the storage battery, together with the necessary lamps, wire and small motors. The battery consists of fourteen cells arranged on an open rack in two tiers. This battery is clean, gives off no disagreeable odor and needs no care except to keep it in a warm, dry place. Near the battery is located the automatic cut-off device which breaks the circuit between the generator and the battery whenever the latter is idle or running at too low a speed to provide sufficient current to the cells.

This well-planned and ingenious outfit is really very simple and costs comparatively little. The items for repairs are very trifling and the farm has plenty of electrical energy at all times. When the wind is idle the storage battery contains enough energy to burn the lights for several days.

The Winsted Gas Company of Winsted, Conn., is extending its electric current to Highland Lake Farm, which will milk its cows, more than 100 in number, by electrically operated cow-milking machines.

TELEGRAPHY—TELEPHONY, and WIRELESS.

THE TELEPHONE AND TRAIN DISPATCHING.

BY K. W. ENDRES.

One of the most important innovations which has taken place in the history of railroading is that being put into effect now by many of the railroads throughout the country, namely, a new modern method of dispatching their trains. The telephone is gradually replacing the telegraph for this service on all the big railroad systems in the United States, and with its arrival departs one of the most conspicuous features that has accompanied railroading since its early beginnings.

The telegraph and the railroad grew up together, and although the telephone has been in commercial service for over thirty years now, it has never broken into this combination to any extended degree until the past couple of years. In these two years the telephone manufacturers have turned their attention to showing the railroads that the telephone was superior to the telegraph for dispatching their trains. The result is showing up now in the rapid extension of telephone service in dispatching throughout the country.

It has been a hard struggle to convince the men who are operating train movements over our great systems that the telephone was superior to the old standard method which they had been using for years and years. They had to be convinced first of all that its safety was absolute; that there was no chance of a mistake being made due to the fact that directions and orders were not clearly understood. That this has been done marks a victory for the telephone.

A train dispatcher must be a man who never makes a mistake, because mistakes in his business are nearly certain to be paid for by a toll of human lives or by a wreck-heap of valuable freight running into the tens of thousands of dollars. The aim throughout in train dispatching is to eliminate mistakes and the result of the effort which has been extended along this line is in the development of experienced men and first-class machinery to handle unbelievable numbers of trains in all kinds of complicated and intricate maneuvers without accident and without delay.

Time is a great essential in handling train movements. With the telegraph a dispatcher has always been limited to the speed at which the ordinary operator can receive messages and work the key, and this speed, even with the most expert men, would not average more than fifty words per minute. Taking the grade of operators which railroads must oftentimes employ at their way stations, due to the actual lack of such operators in the market, it may safely be said that the average speed of telegraph operating is much lower than fifty words per minute in railway dispatching service. Now with the telephone it is easily possible to speak one hundred words per minute and the gain in time is obvious. Furthermore, the operator at the way station writes a message down as he receives it. The telephone therefore eliminates one chance for mistakes which has been existent with the telegraphic method in that the dispatcher sent his message and then wrote it out as it was repeated back to him by the way stations. This, of course, gave mistakes a chance to creep in. Now the dispatcher can call in as many station operators as he wishes, can give them the train orders and have each man repeat the order back to him word by word, spelling out stations and figures and underlining each word as it comes in. The actual results in the two years the telephone has been in use in this country for this purpose have shown that not a single accident has occurred due to the telephone method of dispatching.

Another great advantage which the railroads did not appreciate until after they had their new system in operation was the gain that resulted in discipline and co-operation between the men. It is a funny phase of human nature, but it seems to be a fact, and not an especially surprising one, that when a way-station operator can call up the dispatcher and say, "Bill, No. 32 just passed," he feels much better acquainted with that dispatcher than if he said the same thing by means of a series of dots and dashes. One dispatcher said that he had never been mad since the telephone system had been put into operation and that expresses the whole story.

It is obvious that no matter how mechanical a telegraph operator becomes and no matter how instinctive the translation of telegraph signals from dots and dashes to letters of the alphabet becomes, there is always a nervous strain on the operator. The continual click, click, click, gets on his nerves unconsciously, and the handling of the key tires his muscles and affects his temper. Sarcasm is not at all unknown among telegraph operators and the messages that flash over the wires when a poor operator cannot handle the Morse being sent him, are usually very pointed. This has all been eliminated by the telephone.

The system about to be installed on the Georgia Railroad will equip the division between Augusta and Atlanta, Ga., a distance of 171 miles; and from Camak, Ga., to Macon, a distance of seventy-four miles. This line will consist of a No. 9 B & S gauge hard-drawn copper-wire circuitt, and on this circuit will be installed forty-eight regular selector stations and five siding telephones. The Georgia installation is the first one in this section of the country.

The operation of this system may briefly be described as follows: In front of the dispatcher is a cabinet of keys, one for each station on the line. He calls any station he desires by giving the handle of that particular key a quarter-turn to the right. This starts a clockwork mechanism which sends out a series of current impulses and intervals on the line. The particular

selector corresponding to this combination of impulses and intervals will step its mechanism all the way around and ring the bell at that station. The selector is a piece of mechanism known as the "Gill Selector," and operates on the principle of the ordinary ratchet and pawl, like the escapement in a clock. By means of this piece of apparatus, a dispatcher is able to call any one station on his circuit without ringing the bell of any other way station. When a way station wishes to talk to the dispatcher, all that the operator has to do is to remove his telephone receiver from the hook, press a button and talk to the dispatcher who is connected on the line at all times.

The telephone system is remarkably flexible. Selector stations such as have been described can be added to or removed from the line at will. Furthermore, telephones can be installed at regular sidings, blind sidings, drawbridges, or in fact at any points on the line where the operating officials wish to place a set. In this way train crews may be placed in direct communication with the dispatcher and may receive orders from him directly without the intervention of an operator. Oftentimes it is possible to omit small way stations simply by installing a telephone at the point desired.

The telephone system also permits of trains being equipped with portable telephone sets. The value of these in emergency service is incalculable. In case of a wreck the train crew can get into immediate touch with the dispatcher, and through him with the officials of the line, and can give on the spot those details which will enable the proper assistance to be sent out. These portable sets are attached to the telephone line by means of a jointed fishing pole and can be hooked on at any point whatever.

Other railroads in the south which have recently been very active in adopting the telephone method of handling train movements are the Southern Railroad, which has purchased from the Western Electric Company full equipment for the installation of telephones and selectors on one of its divisions; the Chesapeake & Ohio, which has completed the installation of similar equipment on its Cincinnati divison and expects to have installed within a short time telephone dispatching apparatus on three other important divisions; the Norfolk & Western Railroad, which is equipping 700 miles of its main line, including six dispatchers' districts, with telephone equipment, and already has a portion of this in operation (this railroad plans to cover its entire system with this equipment as soon as possible); the Seaboard Air Line, which has installed the same system on two of its most important divisions, and reports that the operation of the telephones is so satisfactory that further extension is being contemplated; the Atlantic Coast Line, which has been handling trains on one division for some time by this method and is at present extending its service along the same lines; and the Carolina, Clinchfield & Ohio, which operates trains over its whole system by the telephone method.

The system employed by all these railroads is practically uniform throughout. It is what is known as the Western Electric-Gill system and employs the Gill selector with Western Electric telephone apparatus. These manufacturers report that they are being so rushed with orders from the railroads throughout the country for this type or equipment that they are behind in their orders at present and are increasing their facilities to turn out the material. They have standardized telephone train dispatching apparatus and the railroads are employing specially designed instruments of solid construction which will withstand the severe service that they are liable to meet in this type of work. Telephone train dispatching is at present a very live issue throughout the country, and especially in the South.

Regulation of Wireless Telegraph.

To the Editor:

We hear considerable about this in the daily press, as well as the electric and scientific journals. The question that naturally arises first is, "Who are the instigators of this movement, and who will profit by it?"

From present indications it seems to be a move for monopoly and control on the part of some one to acquire entire control of the wireless business and licensed by the Government. In looking carefully over the field, it appears to the writer that there is only one company which is making very large claims, and no doubt, is the interest back of this movement. This company seems to resent competition, because it believes the Almighty intended all the blue sky for them and them only, and all profits from the wireless business to fall into its coffers. It appears to the writer that such is not to be the case, for the Lord intended that this great scientific discovery should be developed for the masses and for the use of the people.

A few independent workers who have been doing commercial wireless work during the past four or five years, are having a hard struggle to meet and overcome every manner of cut-throat competition put up by the company which is flooding the community with literature they are using to drive independents out of the commercial field. If this were to be a fact, it would be very deplorable.

From the writer's personal observation, brought in direct contact with this company, they are the worst pirates to interference, when it comes to a question of interference. Their superintendents and engineers instruct their operators to deliberately interefere wherever these independent workers have stations that are working in opposition and the very people who are making the most noise about interference, are the very worst to create interference.

It appears to the writer that it is time for the student, amateurs and independent wireless workers to combine with the independent wireless systems and perfect an organization and understanding so as to be able to work together through mutual agreements, and thereby accomplish, with a union of of force, and present to the Government a solid front. This combination of independent workers would surely accomplish a great deal along the right direction in regulating wireless telegraph, not with a view of creating a monopoly, because the writer believes there is a great question involved, personal rights as well as dollars and cents.

The hired help of this company is already croaking that they have senators and congressmen at Washington working for them, and it will be a matter of a very short time when all students and independent wireless companies will have to bow to their supreme will in order to operate. This, indeed, would be a deplorable position, and the warning contained in this communication should be sufficient for the student, amateurs and independent wireless workers to sit up and take

notice. The company has its district managers, agents and solicitors stretched out from one end of the country to the other, and they are passing out one grand bunk story about what they are going to do for the student and the amateur, etc., and it behooves these independent workers to get a move on, before they find themslves completely tied up and unable to extend their efforts and lend them to to the commercial development of the wireless telegraph and telephone.

The students and amateurs, also the independent workers should immediately take steps to interview their representative at Washington, petitions should be circulated and the independent workers joined together for mutual protection against the common enemy and monopoly.

A. WOLF.

Detroit, Mich., March 21, 1910.

Wireless Legislation.

TO THE EDITOR:

Of vital interest to those connected with the art of intelligence transmission is the question whether wireless communication should be subject to governmental control or be allowed to shape its own course as have the elder telegraph and telephone.

In favor of government action are the Federal Departments using wireless and about half of the commercial companies, and at a recent hearing in Washington the most formidable arguments advanced in favor of legislation was the nuisance of interference and bogus message sending. Opposed to any present action are the remainder of the companies and a large number of independent investigators and amateurs—they believe that the time is not yet at hand for intelligent and judicial law making.

If "that government is the best government which is least felt by the people governed" be true, legislation upon this new field should be enacted only as a last resort, after all other means of improvement have been exhausted; fortunately we are far from this state of affairs.

Let us first consider the affirmative. What is the nature of this interference? If, when a station in New York is receiving the weak signals of a distant transmitter, a near-by station also transmits, creating "etheric thuds," the receiving operator may hear the local office so loudly as to render the weak signals unreadable. We all know it is hard to carry on a conversation across a buzzing social tea room. Were the problem of tuning sufficiently solved, the adjacent transmitter would not effect the receiver and no disturbance would result. Although receivers can be made which are normally responsive to a certain definite "tune," if the energy of the interfering station be concentrated in what may be likened to sledge hammer blows instead of a rapid series of light taps, the powerful strokes electrically displace the receiving circuit which in regaining its normal condition oscillates, causing signals. Thus the inability to realize proper tuning is largely due to undesirable transmitters which, instead of producing practically continuous surges, expell their energy in intermittent highly damped discharges.

Almost all of the apparatus in commercial use to-day makes use of this type of sender—this fact alone accounts for a large part of the interference, but when combined with poor insufficient management and untrained, unskilled operators, no wonder wireless chaos exists. The truth of the matter may be easily learned by "listening in" to the wireless world and hearing the tumult; amateurs play a very small part, the trouble is due almost entirely to the commercial operator companies and the navy. The government stations oft-times complain of having been misled by false messages sent maliciously or jokingly by some irresponsible amateur. It is undeniable that this has happened, and, if possible, it should be stopped. However an experienced operator can usually detect the spark and sending characteristics of an amateur and discriminate between the "good and evil" messages. One who has mastered the code and gone to the trouble and expense of erecting a costly station usually has more important objects in view than leading government operators astray. While commenting upon the complaint of amateurs "breaking in," that advice reminding one to first cast the cinder from thine own eye is appropriate. The concentrated truth is that a number of those in favor of legislation are so inclined because of their weakness and inability to cope with conditions; the "survival of the fittest" will determine their destiny.

The next question, after the reason for regulation, is how to regulate, and here is another parting of the ways. For the law to clinch wireless is like trying to get the "Half Nelson" on a jelly-fish. Not only is the formulation of satisfactory restrictions a collossal task, but the execution and enforcing of such laws would indeed require more technical skill and mental agility than even our efficient Executive Department possesses.

It has already been stated elsewhere that the present contemplated action must of necessity be based upon past experiences with inferior apparatus and may thus be inadequate and hamper future developments. The solution of technical problems requires technical men, not lawyers, and at least until the art is more settled than is at present the case, science, not law, should seek the solutions. When electric traction interfered with wire communication, also caused underground deteriation by electrolysis, legislation was not called upon to control stray fields and earth currents.

We are on the threshold of new developments in radio-communication; a new transmitter, possessing the desirable property of emitting an almost continuous stream of feebly damped waves, is being developed and promises to greatly facilitate slectivity. The adoptation of more efficient apparatus to commercial conditions, the elimination of useless "demonstration" stations and stock jobbing schemes in general, and the substitution of bona-fide business management promises to largely eliminate undesirable elements in wireless.

In view of the facts that governmental regulation is not an absolute necessity for the art; that it is doubtful if a practical set of beneficial rules could be drawn up; that it would be next to impossible to efficiently enforce the law, and that such action could not wisely and with foresight for the future be undertaken; a large faction of the art are opposed to present legislation, maintaining that "the time is not ripe."

LLOYD ESPENSCHIED.

New York, Feb. 24, 1910.

New Telephone Exchange for Chicago.

The Chicago Telephone Company is making preparations for the erection of a new telephone exchange on Washington Street, between Fifth Avenue and Franklin Street. The exchange is to be completed before May 1, 1915.

ELECTRICAL Advertising *and* Selling

MAKING THE MOST OF ELECTRICITY AS AN ADVERTISING MEDIUM.[1]

BY CHARLES A. PARKER.

There is more than one reason why the progressive central station should regard pushing the more extensive adoption of electricity for signs, windows, and general store illumination as a matter of moment at the present time.

Circumstances combine to make it a live issue and one that cannot be ignored but to the detriment of the concern's progress and profits. To the central station that has been overlooking the possibility of making more of this proposition than it is at present the writer can give no better advice than this:

Go out after this class of business harder now than ever before. Advertise as strongly and as persistently as the corporate purse will permit — or rather, let us say, as strongly and as persistently as the conditions surrounding your own particular circumstances would seem to make necessary.

A word regarding one or two of the reasons to which we have referred will suffice to make our position clear. In the first place, the introduction of modern high efficiency lamps throws a new light on the matter. This question was quite thoroughly threshed out in a preceding article and but little more than a reference to it will be necessary here. It will probably answer our present purposes to call attention to the fact that modern high-efficiency lamps afford the central station the very best reason in the world for going after and getting new business with a rejuvenated energy. And this statement applies to sign, store and window illumination more forcibly, if anything, than it does to other branches of central-station work. It will be quite unnecessary to repeat here the arguments that prove high efficiency lamps innocent of reducing the central-station receipts. No more is it essential that we show in what manner they mean an increase in the long run. It is enough that an increasing number of central stations are coming to recognize the truth of these facts as the days go by. So, high-efficiency lamps have done their full share toward making the question of pushing store, sign and show-window illumination the live issue we believe it to be.

Scarcely less important than modern electrical lamps in this matter is the fact of present and prospective prosperity.

EARLY ENTHUSIASM.

In the early days of central-station electrical development, advertisers took up the question of mercantile illumination for advertising purposes with remarkable eagerness and zeal. They dinned in the merchants' ears morning, noon and night the virtue of the electrically illuminated sign, the value of a brightly lighted display in his show windows, the business-boosting qualities of the electrically lighted store. They did not let him get away from it for a single minute and, as a result, the central-station's business boomed in these lines.

Then the year of 1907-1908 had a depressing effect on this boom. This was natural, excusable, and to be looked for. But the peculiar feature remains that the "gooseflesh" persisted even after the conditions which had caused it disappeared. Prosperity returned after a few months and confidence on the pay-roll, but still many central stations hesitated to take up their advertising where the depression had cut it off. Quite a few have done practically nothing since it occurred. Those that have given the matter their attention seem to have lost much of the old-time enthusiasm and have gone about it in a half-hearted spirit.

Everything we say here, however, is stated in full recognition of the admirable tactics of a small coterie of central stations who quickly recovered from the depression and whose efforts since that time have been attended by remarkable success. In fact, it is the experience of these central stations that makes us bold enough to say that now, in view of present and prospective prosperity, the wise central-station advertiser is he who gets busier now than ever before.

THE WORK TO BE DONE.

Of course there is this fact to contend with, whatever our conclusions may be as to the advisability of taking up this branch of central-station advertising once more with eager comprehensiveness and intensity. And that is that it is going to be a much more difficult task than previously. Not that we should let these difficulties deter us in the least, but it is well to recognize them.

The first of these is the absence of novelty. When central-station advertising was a new and fertile field, pregnant with possibilities, it was easy to wax enthusiastic. A little effort brought in returns in generous proportion to the money and thought invested. Nowadays, however, in place of this inspiring newness, we must solace ourselves with the wisdom that comes with experience and the assurance that the mistakes that characterized the prepanic era need not be repeated.

The second difficulty that suggests itself is one which has already been mentioned in a previous article, namely, that the people who are most approachable and most easily secured are already on the company's books leaving, to a certain extent, only the less likely as subjects for our efforts. This is only a half truth, however, as the new angle that high efficiency lamps put on the matter makes old customers "prospects" in a certain degree.

This much for the difficulties that lie in the path of a renewal of energetic advertising to increase the use of electricity for signs, show windows and stores. Were they multiplied ten times there would still be good and sufficient reason for our attitude.

For just as long as there is a possibility of increasing the central-station's business in reasonable proportion to the advertising expenditure, just so long is there reason for that expendi-

1 The sixth of the present series of articles on "Central Station Advertising" appearing in the second issue of each month.

ture. And who would be guilty of the folly of saying that central-station advertising had accomplished all that it could especially in this field of "electrical advertising" that is growing and winning recognition even in the absence of effort? There is business to be done and business that, without advertising effort, will not come at all or will be very slow in coming.

Aside from the fact that, as a previous article suggested, the welfare of the central station demands that it advertise and thus control the introduction of high-efficiency lamps, it is quite legitimate to ask whether or not present customers are using electricity as an advertising medium to the greatest possible extent and whether or not good, energetic, judicious advertising will not increase the amount.

As a matter of fact, the writer believes that it most certainly will. If you keep after a customer, who now has a six-foot sign—in the proper way, there is a strong possibility that you may induce him to put up a twelve-foot one, with green "wrigglers" running around the border. And it is more than likely that you can persuade the "Palace Credit Parlors" that, if a few well-lighted windows bring in the coin of the realm, that outlining the entrance will bring in still more.

It would be a sad state of affairs if, after a man had put a certain amount of money into electrical advertising, he could never be expected to increase his expenditure.

THE CAUTIOUSNESS OF NEW CUSTOMERS.

If the whole truth were known, this would probably be found to be the situation. When a man who has never had one before puts up an electric sign, he is very cautious about how far he goes. He gets along with just about as small and simple a one as possible. Ask the solicitor how many electric signs he has sold to people who really should have had a much larger one than they contracted for and see if our idea here is not about right. The same thing is true of window lighting and store illumination. We are by no means quarreling with the gradual initiation into the benefits of electrical advertising that most merchants undergo, but merely endeavoring to show that simply because a man is already a patron is no reason for cutting him off the list as one from whom there is nothing more to expect. Of course, this does not mean that after a new customer is landed his life should be made miserable by constant importunities to "come on in for more." He is certain to resent such an attitude and the company will lose his good favor if not his business. This is a place where diplomacy must be employed in your advertising—a fact that does not lessen the profitableness of such effort when it is of the right sort.

All this, then, leaves us to conclude that by the proper kind of advertising, the central station can make a better thing from the merchants use of electricity as an advertising medium than it is at present even among the patrons already on its books.

Outside of this, there is still a large field in which the seed of advertising may be very advantageously sowed. It would be hard to find a central station that could honestly say it had reached all merchants who, by the very nature of their businesses, ought to be generous users of current for advertising purposes, so effectively that there was nothing left to do. Of course, this may be true to a certain extent in the smallest towns, but, as a general rule, it is safe to say that the central station will find plenty of opportunity for the exercise of its energies and talents in this direction.

Just as long as there are clothing stores, shoe emporiums, drug stores, etc., in your town whose location is unmarked by night by an electric sign or whose windows and interiors are uninitiated to the brightness of the incandescent's glow, just so long should your advertising vigorously and persistently preach the gospel of electricity as an advertising medium.

Are you going after this class of business as hard to day as you were three or four years ago before the panic put a crimp into your operations? If you are not doing so, it is high time that you got busy. Increasing numbers of central stations, stimulated doubtless to some extent by the progress made in the manufacture of electric lamps, are doing this very thing and are reaping the rich rewards of the energetic. It will pay every central station that has not felt the influence of this wave of enthusiasm to fall into line quickly.

GET INTO THE "NEW FIELDS."

Perhaps as great a reason as any for taking the attitude toward this question that the writer advocates is to be found in the fields that have hitherto, in a large number of cases, been lying fallow and uncultivated. Some who have not watched electrical development carefully may be tempted to question the existence of such fields as we mention. But nevertheless they do exist and may be classified under the heading of "businesses, which by their nature, would not seem to be logical users of electricity as an advertising medium." The writer uses the word "seem" advisedly. For these businesses are only apparently beyond the sphere of electrical advertising. They are outside the scope of the electric sign just about as much as certain lines of industries were believed in bygone years to be outside the the scope of magazine advertising. Who would have believed ten years ago that manufacturers of everything from tools to caskets would be reaching out to the ultimate consumer through the popular magazines.

But they are doing just this very thing and in increasing numbers. The week does not go by that does not see some manufacturer becoming a national magazine advertiser.

If they find this popular appeal profitable, why should they not find that equally as powerful medium for reaching the public purse, the electric sign, quite as profitable.

The truth of the matter is they do. National advertisers are using electric signs in many cities. If the central station takes the initiative, there seems to be no reason why it should not enjoy an increase in revenue from this source. Much too may be gained by friendly co-operation with sign makers who are apt to be in closer touch with the national advertiser than the local character of the central station allows it to get.

But don't let this little digression into the realm of the national advertiser convey the idea that the central station can find no new fields at home to which its efforts can be successfully directed. There is plenty of room for work. The local manufacturer would find an electric sign profitable especially if he is located on a navigable river or on the railroad, and if his product is one that the public ought to know by brand or name. In the larger cities, this class of manufacturers show their recognition of the value of electrical advertising by putting up signs many of which dwarf those of the retailer by a great deal.

Any one who has traveled the lakes for instance cannot fail to be impressed by the sign erected on the Canadian side of the Detroit River opposite Detroit. "The Distillery of Canadian Club—Walkerville." The sign blazes forth from the time navigation opens until it closes, and it is safe to say that the imbiber who has seen it thinks of it whenever he calls for his favorite. What its sign does for the Walkerville Distillery, a suitable electric sign ought to do for almost every manufacturer especially, as we said before, if he is so located that passengers on passing trains or boats can read it. The central station that does not consider at least certain manufacturers as prospective candidates for signs as well as for power is going to miss something good.

(To be continued.)

A Good Example.

According to a London electrical journal, a central station in London England, is publishing a booklet entitled "Electricity Consumers' Guide," which is being very favorably received by its customers and prospective customers.

The reading matter is divided into convenient paragraphs, with explanatory headings printed in red. Contained in the booklet is the information that the corporation experts will give advise gratis, will undertake to supervise the local contractors' wiring, and will even pay the bill at once, and allow the customer to refund at leisure, granting three years' time.

Other headings tell the consumer the "Procedure to obtain a Supply," "Service and Meter," "Notes on Wiring of Premises," includes paragraphs on "Main Switches and Fuses," "Distribution Board," "Fuses," "Systems of Wiring," "Distribution of Lights and Choice of Fittings," "Choice and Efficiency of Lamps," in the course of which the respective merits of arc lamps, carbon filament and metal filament (tantalum and tungsten) are discussed. Then follow notes on "Switches," "Special Plugs," "List of Installations" (with examples), "Heating and Cooking," "Rental System of Charging," "Annual Cost of Electricity" (with examples).

The information, of course, is of an elementary character for the non-technical public, but it is adequate and, while concise, admirably lucid.

Electric Sign Business in Toronto.

As an instance of the amount of sign business closed by the sales department of the Toronto Electric Light Company, Toronto, Canada, under the management of Eugene Creed, eighteen electric signs were installed in Toronto during the month of February.

This credible showing is due partially to the low sign rate charged by the company, but principally to the energetic new business methods in operation in that city.

Several of the signs installed are exceptionally large and are typical of the wonderful progress being made in electric sign construction.

In the accompanying illustration is shown a view of one of these signs built for the "Saturday Night" by Death & Watson. This sign is situated on the

VIEW OF ONE OF THE LARGE ELECTRIC SIGNS RECENTLY INSTALLED IN TORONTO.

roof of a building at the intersection of Yonge and Queen Streets and shows a fountain flowing downwards with the words "Read Saturday Night" in red. The lamps outlining the fountain are green and those outlining the water white. The sign is forty-five feet high and thirty-six feet wide and there are over 1,250 lamps used.

Another prominent sign will be that installed over the cleaning and pressing establishment of a Mr. Fountain. This sign will typify an immense fountain with the words "Fountain" running perpendicularly, "My Valet" at the bottom of the sign in a horizontal position and the fountain typifying the name.

A large sign typifying a fountain filling soda glasses at regular intervals is another sign worthy of mention, which has been installed over a drug store on Yonge Street.

Bulletin of the Philadelphia Electric Company.

Under this caption the Philadelphia Electric Company, Philadelphia, Pa., publishes at frequent intervals an attractive booklet containing material interesting to both consumers and prospective consumers.

As an indication of the function of this organ, the current issue includes an article on street lighting in Philadelphia; information regarding the price of tungsten lamps; an article pertaining to electrical advertising; a description of the recent electrical show and notes on electric vehicles.

Thus it may be seen that every class of consumer may find something of interest to him in this bulletin, which makes for closer co-operation between the public and the central station.

Increasing the Lighting Load.

The sales department of the Toronto Electric Light Company, Toronto, Canada, is carrying on a lighting campaign which, owing to its commendable features, may offer suggestions worthy of consideration.

A letter is sent to each prospect offering the services of its illuminating engineering department for data and advice regarding the installation of a scientific system of illumination. This is followed by the visit of a solicitor who explains in detail the services at the disposal of the prospect. Later another letter is sent again offering the services of the illuminating engineering department and assuring the recipient that the services rendered are entirely free.

Advertising Copy for Central Stations.

A neatly bound book containing twelve attractive specimens of advertising copy for central stations is being distributed by the Westinghouse Electric and Manufacturing Company, Pittsburg Pa.

For central stations in general and particularly for those not maintaining a regular advertising department this collection of copy, setting forth the advantages of electric power, should prove beneficial.

The text of the advertisements is concise and directly to the point and the style of type is indicated for each piece of copy for the guidance of the printer. This "Ad Book" is sent free to a central station upon application.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

School Telephone Systems in Birmingham, Ala.

Interior telephone systems have their distinct usefulness in schools, where they assist to a great degree in organizing and centralizing class rooms and departments. Where formerly call-bells, speaking tubes and other methods of signaling, many of them inconvenient, were used, the telephone today is able to perform better work and to bring about system and unity.

The accompanying illustrations are from photographs taken in the public schools of Birmingham, Ala. The introduction of interphone systems is a feature of the modern equipment of these buildings. Fig. 1 shows the installation at the South Highland Public School. The equipment here consists of thirty-four wall sets and a master station. Fig. 2 is a photograph taken at the Alberto Martin School. A master station and twenty-two special wall interphone sets have been installed in this building. Fig. 3 was obtained at the Lake View School, where the telephone equipment consists of eight local stations and one master station.

In each of these systems the instruments are so arranged that the master station which is located in the principal's office can call any of the stations of the wall type, while any of the local stations can call the principal's office. When it is desired to do so, the principal, or any one convenient to the master station, can connect any two of the local stations.

This affords a means of constant intercommunication among the class rooms in the principal's office, connecting all these with the janitor's office and with any other convenient location where it may be found advisable to locate one of the interphone sets.

This school system is a central battery system. That is, the batteries are located alongside of the desk set in the principal's office and are not necessary for the wall sets distributed about the class rooms. This makes for much greater convenience and economy.

These systems are manufactured and installed by the Western Electric Company, the concern which has made all the 5,000,000 "Bell" telephones. The

FIG. 1.—TELEPHONE IN PRINCIPAL'S OFFICE.

master telephone set in each case has connecting buttons mounted on the front of the case, each provided with a name plate labeled with the name of the station with which it connects. Merely pressing a button rings the bell of the telephone at the corresponding station. Conversation is then started in the usual manner by lifting the receiver from the hook.

To call the principal's office from any of the other stations it is neces-

FIG. 2.—SUBORDINATE'S DESK.

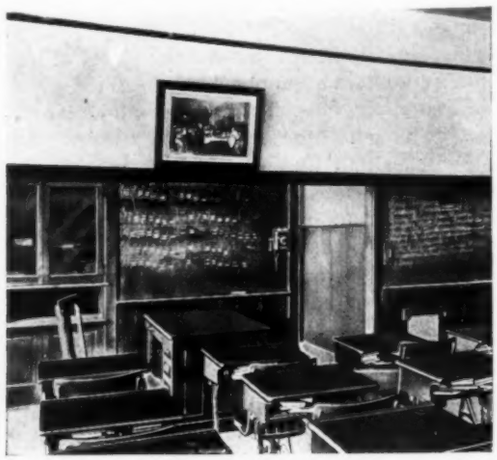
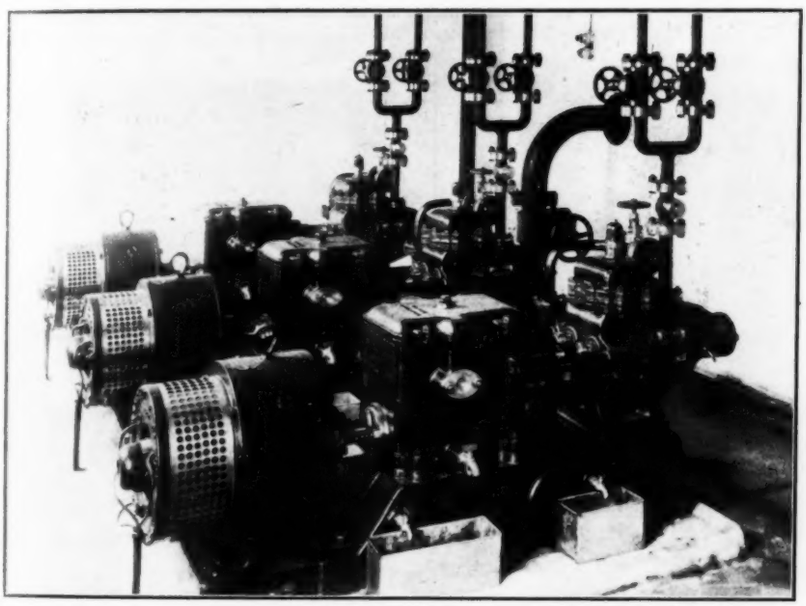


FIG. 3.—TELEPHONE IN CLASS ROOM.

sary only to press a small button at the side of each set and proceed as before. With this system the principal can at any time call for any or all of his teachers. It is a sure and efficient way of spreading the prompt dismissal sign in case of necessity. Each of the teachers has the realization that she is able at all times to get into instant communication with the principal, which is often found convenient in case of trouble.

Electrically Driven Boiler-Feed Pumps.

There are a number of auxiliary machines requiring power connected with every power house attached to a mine, and in a large number of cases they are driven by steam engines often totally unsuited to their work and using a large amount of steam.



ELECTRICALLY DRIVEN BOILER-FEED PUMPS.

Great economy can frequently be effected by driving auxiliary machinery, such as boiler-feed pumps, condenser pumps, coal and ash-handling plant, etc., by electric motors.

The accompanying illustration shows a group of three electrically driven boiler-feed pumps, of a special type developed by the firm of Crompton & Company, Ltd., of London, England. A fourth pump has since been added. Each pump is capable of delivering 600 gallons per hour against a pressure of 180 gallons per square inch, and the pump and motor are mounted on a self-contained cast-iron bedplate. The pumps are of the outside packed plunger type driven by worm reducing gear.

The motors are of the protected type, shunt-wound, giving two brake-horsepower at 480 volts.

The fourth pump which has been installed (size, two and one-half by four inches) gives an output of 1,000 gallons per hour against 180 pounds per square inch, and is driven by a 3.25-brake-horsepower motor running at 1,120 revolutions per minute when supplied with current at 480 volts.

The Wisdom and Value of Duplicate Batteries.

The General Vehicle Company gives the following interesting advice to owners of electric commercial vehicles as a means whereby, at very slightly increased cost, they can very largely increase the efficiency and capacity of their vehicles and accomplish very much more satisfactory results.

Broadly speaking there are two conditions which render it highly profitable and advisable for the owner of an electric vehicle to purchase and maintain duplicate storage batteries: (1) When the actual or possible service of a vehicle exceeds the mileage or capacity of a single battery; (2) when the owner operates his own electric power plant. These conditions, and the excellent economies which they represent, are worthy of careful consideration.

Under the first condition, let it be remembered that the vehicle—not the battery—is the major part of the investment, and if, by making the original investment a trifle greater to cover an additional battery, the earning power of the vehicle can be doubled, the advantage and economy are manifest. Suppose, for example, the working conditions of a business call for wagons of 2,000 pounds capacity. The standard one-ton wagon of the General Vehicle Company has a guaranteed mileage of forty-five miles on a battery charge, carrying full load half way. Hills along the route would reduce this a trifle, say to forty miles. Now if the shipper can figure out a method of making that vehicle cover eighty miles per day, thus doubling its earning capacity, the result can easily be accomplished by shifting bateries at midday—a process consuming only a few moments' time. Of course, where a great many delivery stops are made and where the distance between stops is relatively short, it is doubtful if more than forty to forty-five miles could be covered, but such a plan holds splendid possibilities to shippers who make long-distance hauls. And a matter of fact such procedure often enables the electric truck to invade the field of long-distance work, which has generally been conceded to the gasoline vehicle.

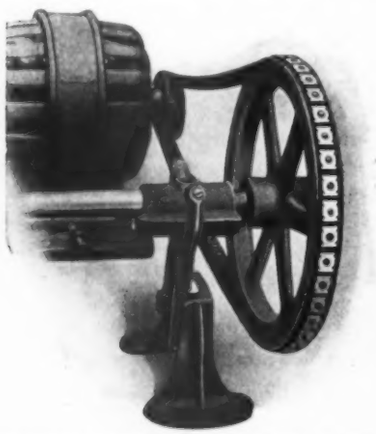
Where the shipper produces his own electric power, as in a manufacturing plant or large department store, for example, operating his generators during the working day only, duplicate batteries enable him to do his own charging during the day, working each set every other day, and saving the difference between the central-station company's rate and his own cost for electricity. Under conditions where this system is possible the savings in charging costs will pay high rate of interest on the investment in an extra battery, with the further advantage of giving the engineer or electrician of the plant ample time to keep each battery in the pink of condition.

Batteries are generally arranged in several crates for ease of handling. Where the charging is done at night automatically, or supervised after simple routine directions by a night watchman, the actual management and care of the batteries being under a day man, electric-vehicle owners are advised to have on hand an extra crate. This enables the regular battery man to take plenty of time to keep every cell in the best condition without working overtime.

If a cell in any crate is low, that crate can be removed for attention. Similarly, the specific gravity of the acid in each cell can be standardized at leisure, and cleaning of the trays of cells done thoroughly at convenient times, by taking each in rotation. The cost of an extra tray is very small and the advantages to be derived under many conditions are well worthy of consideration.

A Noiseless High-Speed Chain Drive.

The disadvantages of belt drive are many and various. In order to transmit power in fairly large amounts the belts must be submitted to a certain degree of tension, and in short drives the use of idler pulleys must be resorted to in order to afford a large enough area of contact of the belts on the pulleys. Every once in a while, owing to permanent set taking place under continued tension, belts must be "taken up," in order to keep them tight enough to transmit the required power. Belts may be driven at high speeds which in practice vary from 1,000 to 3,500 feet a minute, but at the higher speeds centrifugal action materially affects the power transmitted.



TWO-HORSEPOWER PEERLESS - V - BELT DRIVE, OPERATING SEWING MACHINE LINE SHAFT.

Chain drive possesses certain advantages over belt drive, and some disadvantages of its own. For instance, with chains the drive is positive, friction does not enter in account (when sprockets are used), and tensioning devices, while necessary in some cases, are ordinarily not required. Furthermore, very short drives are easily obtainable. The chief disadvantages of chain drive are the accompanying noise and the comparatively low speeds which can be used. With block chains the safe limit of speed is about 600 feet per minute; roller chains may be used from this speed up to 900 feet per minute; and Renold silent-driving chains may go up to as high as 1,300 feet per minute.

Thus, without going further into detail of the advantages and drawbacks of the two kinds of drive, it is apparent that each type has some advantages not passed by the open.

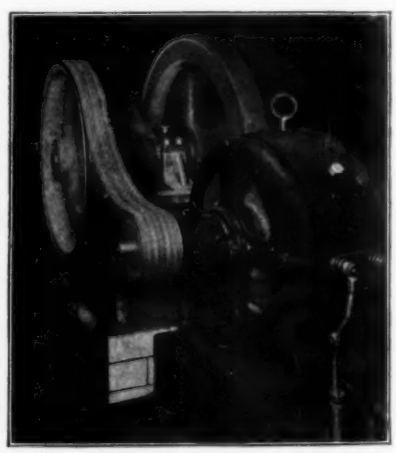
A new drive which comprises characteristics of both drives has been for some time on the market, and results seem to indicate that it combines the advantages and eliminates the disadvantages incident to belts and chains. This drive operates safely and econonomically, under ordinary conditions, at speeds up to 2,000 feet per minute, and when large sheaves and long distances between pulley centers are used, the speed may be increased up to 3,000 feet. This Peerless-V-Belt, as it is called, is a noiseless chain that has been operating satisfactorily under many conditions

TWO-HORSEPOWER PEERLESS - V - BELT DRIVE OPERATING VACUUM PUMP.

The Peerless-V-Belt, which is made by the Peerless-V-Belt Company, 334-338 South Clinton Street, Chicago, Ill., operates on the principle of the wedge, running in grooves made to the same angle as the belt, but much deeper than the latter so that the belt does not come in contact with the bottom of the groove. The wedging action precludes slippage entirely, and is so perfect that the belt may be run slack, thus doing away with undue pressure on the bearings. The belts are noiseless in operation, they can be run at high speeds on short as well as on long centers, and are not affected by moisture, oil, dust or grit. Furthermore, the belts can be operated singly or in multiple, the number of strands depending on the horsepower to be transmitted.

All of these features make the Peerless-V-Belt peculiarly suited for motor drive, examples of this use being shown in the accompanying illustrations.

In construction the Peerless-V-Belt consists of a bevel steel chain for a core, a continuous strip of Krome tan leather from below, a sectional strip of friction board for top, all parts are held firmly in place by a rivet passing through. The joints of the chain are frictionless and are designed so that the bearing surfaces of tool steel roll against each other. This type of joint insures longevity. The method of construction is such that the friction material can bend around small sheaves without injuring the fibers. The chain and friction material are therefore of equally long life.



FIVE-HORSEPOWER PEERLESS - V - BELT DRIVE OPERATING AIR COMPRESSOR.

Galvaduct Conduit.

One of the interesting demonstrations at the recent Minneapolis Electric Show, which attracted a great deal of attention from central-station men, electrical supply men, and contractors, was the exhibit of Galvaduct conduit with enameled interior, which was made by the Western Electric Company, and by the representatives of M. B. Austin & Company, Chicago. The manufacturers of this type of conduit are enthusiastic over the popularity with which it has been received, and it is reaching an increasing market for many varieties of service.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, MARCH 25.—The Municipal Council of Paris has extended the concession of the General Omnibus Company for a period of forty years for the tramway and omnibus lines which it is now operating. According to the terms of the new contract relating to the concession, the company is given the space of three years for changing over the omnibus lines to the automobile system. On some of the lines this change has been already made. As regards electric traction, the space of five years is allotted for changing over to electric traction on all the tramway lines of Paris and the suburbs which the company is now operating. This will mean a considerable amount of work in installing electric tramway lines and will result in large orders being placed with the leading supply houses.

A hydraulic plant is now in course of erection on the Cismone River in Upper Italy which will be one of the large stations in that country when it is entirely completed, as it will then have 20,000 horsepower installed. At a point near Ponte di Serra there is erected a dam of thirty-five meters height upon foundations of twelve meters depth. In this way the water is backed up so as to form an artificial lake about one and one-half miles long which gives a good reserve supply. Following the dam is a flume ending in a penstock of two meters diameter and this is brought down to the turbine station which is located at Fonzaro. At present there are three main turbine and alternator groups set up in the plant, each of which is of the 3,500 horsepower size. Transformers raise the voltage to 35,000 or 60,000 volts for two different sets of power lines. Among the leading cities to receive current from the Cismone station are Venice, Padua and Rovigo.

The town of Neufchateau, in Luxembourg, is to make use of the falls which are located at the reservoirs of Grandvoir in order to operate a turbine plant. Current is to be used for light and power within the town itself and also for use upon a power network which will take in the town of Bertrix and other neighboring places.

During 1911 there will be held an international exposition at Roubaix, which is the center of an extensive manufacturing district in the north of France. The electrical industries are well developed in this region, among which we may mention the extensive interurban line in the neighborhood of Roubaix. The exposition is held under the patronage of the Government and the leading Chamber of Commerce, and it is expected that foreign countries will be well represented in the exhibits. The electrical section is to be one of the prominent features of the show.

The French government has been acting in co-operation with the German telegraph department for the establishment of a direct telegraph line between Paris and Munich, and it is expected that this will be open for public service before long.

M. Paul Jegou, a leading Paris engineer, has invented a new electrolytic detector which differs from the ordinary in that it does not require a battery in connection with it. At the same time it has all the advantages which belong to the electrolytic detector.

The Municipal Council of Tunis has taken measures for extending the concession of the gas company for the electric supply of the city. The concession will be now extended to 1956.

A. DE C.

EASTERN CANADA.

(Special Correspondence)

OTTAWA, ONT., APRIL 2.—The annual statement of the Canadian Westinghouse Company shows that the profits for the year ending December 31, were $498,379. The sales for the year were the largest in the history of the company.

The report of the Canadian General Electric Company, of Toronto, one of the important industrial concerns in Canada, shows that the company has a larger number of orders than ever before in its history.

A compromise over the St. Lawrence Power Transmission Company's bill, now before the Dominion parliament, is to the effect that the passage of the bill shall not be taken to endorse the larger proposition of the damming of the Long Sault Rapids, and that the company shall be restricted to the transmission of power generated from the company's existing plant.

One of the most important measures passed this session of the parliament of Canada, was the bill to give the Dominion board of railway commissioners control of the rates and facilities of cable companies. Tariffs and tolls must first be approved of by the board. That urgent messages will be transmitted first will be one of the regulations.

There is a formidable movement on foot by a group of Canadian capitalists to secure control of the Montreal Street Railway and the Montreal Light, Heat and Power Company. The statement is made that these capitalists have already obtained a voting power of 40,000 shares of street railway stock, and will lay siege to the stock of the other company in a very short time. So far the identity of the purchasing group is not known, but it has three banks at its back, and seemingly many millions of money at ready command.

The bill of the Suburban Electric Tramway Company, now before the Quebec Legislature, is one of the three bills submitted to that body by companies seeking power to build subways under the streets of the city of Montreal. The Montreal Street Railway is behind this bill but has also a bill of its own for an underground railway service. The undertaking of the Suburban Electric Tramway Company is estimated to cost in the neighborhood of $25,000,000. The names of the other two concerns applying for incorporation, are the Montreal Underground and Elevated Railway Company and the Suburban and Terminal Company. A bitter fight over these applications is expected to be waged before the House committee.

A firm of Montreal stock brokers, McCuaig Brothers & Company has purchased the street railway of Sherbrooke, Que., which has $200,000 stock and $159,000 outstanding bonds. The same firm has also bought three water powers in the vicinity of the city of Sherbrooke, and, having secured an extension of the franchise for a period of forty years, it is the intention of the new owners to extend the road considerably. A large amount of money will also be expended in developing the power plants which will afford the sale of 2,500 horsepower above the company's own requirements.

W.

LIGHTING AND POWER.

(Special Correspondence.)

WETUMKA, OKLA.—This city has voted electric light bonds to the amount of $36,000. P.

ELGIN, TEX.—The Elgin Light and Power Company has been chartered with a capital of $15,000. P.

FORNEY, TEX.—The Forney Electric Light and Ice Company has been incorporated by Yancey McKellar and others. P.

LIBERTY, MO.—The Liberty Electric Light and Power Company has been incorporated with a capital of $50,000. P.

OWATONNA, MINN.—A vote is to be taken on the issuance of bonds to the amount of $50,000 for an electric light plant. P.

WILBURTON, OKLA.—This city has granted an electric light and gas franchise to the McLoud Construction Company, of Kansas City, Mo.

CRAB ORCHARD, NEB.—At a special election recently held here, $2,800 in bonds was issued for the installation of an electric light plant.

LOS ANGELES, CAL.—Messrs Aldwell and Glines have asked for a franchise in connection with their proposed development of the Elwah River power. A.

ASHEVILLE, N. C.—The Dixie Mining and Power Company, has been chartered here with $200,000 capital, by A. E. Swayne, and associates, of this city. L.

NEW EGYPT, N. J.—The New Egypt Light, Heat, Power and Water Company, has been incorporated by G. L. Shinn, W. C. Jones and W. Chambers, New Egypt. The capital is $30,000.

PARRAL, STATE OF CHICHUAHUA, MEXICO.—The Parral Consolidated Mines company has equipped its mine pumps here with electric motors. The hoists are also operated by electricity.

NORTH BALTIMORE, OHIO.—An ordinance has been passed by the council granting F. J. Miller, of Fostoria, a franchise for an electric light plant. The plant must be completed within ninety days.

OPELIKA, ALA.—The mayor of Opelika will receive bids until April 15 for furnishing electric lights to the city and its citizens. The lighting service is to begin at the expiration of present contracts.

CARSON CITY. CAL.—Messrs Cain and Metson have purchased the water rights to Jundy Lake, Mono County and will build a plant to transport power to Bodie, Aurora, Masonic and Lucky Boy. A.

NEW LISBON, WIS.—The mill property, water power and water rights at New Lisbon have been purchased by the Mauston Electric Service Company. Extensive improvements will be made by the new owners. M.

AUGUSTA, Me.—The Dixfield Light and Improvement Company has been incorporated to deal in gas and electricity. The capital

is $25,000, and the incorporators are : R. S. Buzzell, president, and E. J. Pike, treasurer.

MODESTO, CAL.—The Board of Supervisors has accepted the application of the Lagrange Light & Power Company for an electric transmission franchise along certain county roads and has ordered the proposed franchise to be advertised for sale.

FT. WAYNE, IND.—The city council has contracted with the Ft. Wayne Electric Works for the installation of a new turbine generator and additional apparatus for the municipal electric light plant. The contract price is $33,195. S.

ALBANY, N. Y.—The Southern New York Power Company has been incorporated by A. H. Sewell, Walton; R. C. Megarel, New York, and C. A. Graves, Brooklyn, to furnish electricity for light, heat and power. The capital is $50,000.

BINGHAMTON, N. Y.—This city has under consideration a plan for the erection of a municipal lighting plant by private capital. If this idea is carried out the city will have an option on purchasing the plant at the expiration of five years.

TUSCALOOSA, ALA.—An appraiser has been appointed by the Tuscaloosa Light Company, in the matter of purchase of their plant by the city. The two appraisers will meet, choose a third and will then decide in the value of the property.

FITCHBURG, MASS.—The Fitchburg Gas and Electric Company is making improvements in its system, which will enable it to meet power requirements for several years to come. The work is being carried on by Clifton R. Hayes and George W. Stiles.

TOLEDO, OHIO.—Arrangements have been made for installing eighteen lights on Main street, between Front and Second, next week. Lights similar to those on Summit street will be used, and Main street will become a part of the city's great white way. H.

BELTON, TEXAS.—W. W. Thornton and associates have placed an order in Pittsburg, Pa., for the machinery for the new electric light and power plant that they will install here. It is expected to have the plant ready for operation in about two months' time. D.

WOONSOCKET, R. I.—An act has been passed giving the Manufacturers Power Company the right to string wires and lay conduits in the vicinity of the Samoset and Nyanza mills. The power company is to supply these two concerns with steam and electric power.

HEMPSTEAD, TEX.—A movement is being made by J. C. Amsler, Robert Morrison and others to install an electric light plant here. An entirely new set of machinery will be installed and it will be sufficient capacity for both the residence and business districts.

CAMDEN, N. J.—The Juniata Valley Construction Company has been incorporated with a capital of $50,000, to construct electric, steam and gasoline railroads. The incorporators are: A. J. Starr, H. E. Steel, G. W. Fisher, B. F. Godard, Huntington, Pa.; H. E. Truax, Camden.

HAWKINSVILLE, GA.—The new electric light plant owned by the city will soon be ready for use. The machinery has all arrived and is being rapidly installed by Mr. Wilkes, constructing engineer for J. B. McCrary & Company, of Atlanta, who contracted with the city to install the plant.

OKLAHOMA CITY, OKLA.—It has been announced by manager Hibborn of the Great Western Power Company, that the contract has been let for the erection of a new 15,000 kilowatt substation. The McGilvery Construction Company which secured the contract will begin work at once.

CENTRALIA, WASH.—A right of way from the Thurston County line to Chehalis has been granted the Tenino Light and Power Company which has a power site on the head waters of the Shookumchuck River in the Development of which, the company has already spent $40,000. A.

GOUVERNEUR, N. Y.—Urban O. Webb of Edwards has been given permission by the Public Service Commission, second district, to operate an electric lighting plant in that village and to exercise the franchise given it. Mr. Webb recently completed the construction of a plant there.

BIRCHWOOD, WIS.—The Wisconsin Light and Power Company is preparing to construct a modern roller concrete dam to take the place of the old wooden structure at the foot of lower Birch Lake, which is over thirty years old. The new dam will be four feet higher than the present one. M.

MOHAWK, N. Y.—The municipal commission, the members of which visited various places with a view to investigating as to the advisability of building an electric light plant here, has given up that idea, having renewed the contract with the Utica Gas and Electric Company at a rate of advantage to the taxpayers.

EAU CLAIRE, WIS.—Men interested in the Chippewa Valley Railway, Light and Power Company of Eau Claire, have bought the entire capital stock of the Chippewa Falls Water Works and Lighting Company, taking possession of that property April 1. The property includes water works, electric light and power plant, and gas works, all at Chippewa Falls.

CENTRALIA, WASH.—The Board of County Commissioners has granted a right-of-way for power lines from the Thurston County line to Chehalis for the Tenino Light and Power Company. The franchise is for twenty-five years. The company has a power site on the headwaters of the Skookumchuck and has already spent about $40,000 developing it. It is said to be the intention of the company to spend a quarter of a million dollars in the scheme.

FAYETTEVILLE, N. C.—The plant of the Fayetteville Gas and Electric Company has passed into the hands of William H. Randolph, of Essex county, New Jersey, Mr. Randolph being consulting engineer of the Tidewater Power Company, Wilmington, N. C. Thomas Badger, who first bought in the property at $11,000 at a court sale, is mentioned as the probable manager of the Fayetteville property.

BANNING, CAL.—The Consolidated Reservoir and Power Company has begun work on its property near here. Water will be diverted from Whitewater River at a height of 7,000 feet in the San Bernardino Mountains and carried six miles in cement pipes. Power will be developed and the water afterward used for irrigation. H. Edwin Moore of Los Angeles is president and W. B Scarborough of Monrovia secretary of the company. A.

BIRMINGHAM, ALA.—Electric power is to be installed by the state convict department in the Alabama Cotton Mill at Speiger. This improvement will require an expenditure of $40,000 for preliminary work, including construction of concrete drains, and an expenditure of $25,000 for the electrical machinery. The installation is expected to effect a saving of about $7,500 annually. The mill has an equipment of 6,600 ring spindles and 234 thirty-six inch looms, producing duck and osnaburg.

SAN FRANCISCO, CAL.—Hunt, Mirk & Company of San Francisco have closed a contract with the Municipal Light and Power Company of this city for an additional Westinghouse-Parsons turbo-generator of 1,000 kilowatt capacity, to be used in an extension to the company's existing power plant in the Claus Spreckels Building Annex on Stevenson street. The same firm will also furnish the required additional Stirling boilers, condensers and cooling plant. D.

OROVILLE, CAL.—Water locations for two new electric power plants have been filed for record here. One was for 1,200 inches of the water of Chico Creek, near Cohasset, by F. E. Mann of that place, who proposes to generate electricity for commercial purposes. The other, for 3,000 inches, was filed by A. E. Smith, President of the Butte-Magalia Consolidated Mining Company, which proposes to generate power on the west branch of Feather River for the company's use.

COLUSA, CAL.—The Pacific Gas and Electric Company of San Francisco now has a force of men in the field surveying a route for a new electric transmission line from Marysville to Meridian and from the latter town to this place. Besides supply-power for lights, the new line will furnish power for the Northern Electric Company's railway lines. The new line will carry 60,000 volts as compared with 8,000 carried by the old line. New wires are to be strung for the distribution system in this city.

CLINTON, IA.—The Clinton Gas Light and Coke Company will construct a new central electrical power plant in this city during the present year, according to an announcement just made. The plant will be thoroughly modern and up-to-date, equipped with turbine engines with the vertical type and other modern machinery, while the old machinery will be discarded. Further details regarding the propose new plant will appear later. City Engineer R. C. Hart is at work preparing the ground for its construction.

ASHLAND, WIS.—The engineering work of the Ashland Light, Power and Street Railway Company has been placed in the hands of C. A. Hutchinson of Portland, Ore. He will take charge of the work on the White River dam at once. In order to save the expense of erecting a separate power house and several miles of transmission lines, the power from the Copper Falls dam is to be transmitted to White River, and thence to Ashland. Mr. Hutchinson will take charge of the work at Copper Falls after the White River project is completed. M.

AUGUSTA, ME.—A water power development that will mean about 50,000 horsepower on the East branch of the Kennebec River is under consideration by Engineer S. W. Philbrick of Skowhegan and his associate, who control the necessary rights and privileges, have drawn deeds for all the property which it is necessary to hold in order to build dams in this vicinity on the East branch and nearly all the deeds have been signed and are at present deposited with the Portland Trust Company. The promoters are not yet decided how many and how great dams will be built.

MONTGOMERY, ALA.—At a recent meeting of the stockholders of the Montgomery Light and Water Power Company, the following board of directors was elected for the ensuing year: Henry L. Doherty, Frank W. Frueauff, R. J. Chambers, Paul R. Jones, C. B. Gilbert, H. C. Davidson, S. Roman, F. B. Fisk, S. Gassenheimer, N. J. Greil, Charles N. King, W. K. Pelzer, L. B. Farley, E. G. Fowler. This board elected as officers: Henry L. Doherty, president; Frank W. Frueauff, vice-president; R. J. Chambers, vice-president and general manager; V. B. Day, secretary and treasurer; C. B. Gilbert, assistant secretary.

TEXAS CITY, TEXAS.—It is announced by A. B. Wolvin of

Duluth, Minn., president of the Texas City company which is establishing extensive port facilities at Texas City that the capacity of its power plant here will be doubled in order to supply power for the industries of the town and nearby places. The plant is at present equipped with machinery capable of generating 500 kilowatts. The company is erecting several large warehouses upon the docks here and is equipping them with electric overhead cranes for the handling of freight. Electric cranes are also being installed upon the docks for loading and unloading vessels. Electric motors, using the third-rail system, will handle the cars in the yards and upon the docks. D.

BALTIMORE, MD.—A bill incorporating the Deer Creek Electric and Power Company has been introduced in the House by Mr. Sullivan, of Harford county. The incorporators are Mr. J. Frederick Crew, Hugh J. Jewett, Edward M. Allen, James T. Jones, George E. Silver, Michael H. Fahey and D. Gilpin Wilson. The company intends to construct dams on Deer creek for the purpose of generating electricity. The bill gives the corporation the right to transmit its current in the most practicable way and routes to any section of the State. It is necessary, however, for the company to get the consent of the officials of any city or county to lay its lines. The company is also given the right to acquire or consolidate with any competing company.

APPLETON,WIS.—The Wisconsin Traction, Light Heat, and Power company is to install at once two 750 horsepower low pressure steam turbines in the Appleton power house. The company is now receiving power from two 1,250 horsepower Corliss engines, in addition to 2,500 horsepower of water. A rumor is in circulation that the Wisconsin Traction, Light, Heat, and Power Company, of which John I Beggs of Milwaukee is president, is endeavoring to effect the consolidation of all the interurban companies in the Fox River valley. The companies in this proposed merger would be the Green Bay Traction Company, the Winnebago Traction Company, and the Eastern Wisconsin Railway and Light Company, representing an investment of $5,000,000 and with a trackage of over eighty miles. M.

CRAWFORDSVILLE, IND.—Prof. J. W. Esterline, engineer of Purdue University, employed to examine the municipal light plant, reported to the city council that the plant was completely worn out and recommended the construction and installation of a new plant from the ground up. He recommended an arc lighting system which can be operated from the same alternating current generators and the installation of luminous arc lamps operated from 2,300 volt rectifiers and regulating transformers located in the station. He also recommended for the generating equipment the installation of sixty-cycle three-phase 2,300-volt steam turbin units directly connected to the alternating current generators. He recommended one unit of 500 and one of 300 kilowatts capacity, with space left for the adding of additional units whenever demanded. He also recommended steam turbines for the reason that they are of the best and most economically operated. The cost of the plant recommended by Mr. Esterline is placed at $93,000. It is understood the city council is favorable to the immediate installation of a new plant. S.

ELECTRIC RAILWAYS.

(Special Correspondence.)

COALINGS, CAL.—An ordinance has been passed granting C. L. Morrill a franchise for an electric street railroad. A.

MAGNOLIA, MINN.—A stock subscription of $32,000 has been raised towards the construction of the line to connect Omaha, Neb., and Sioux City. C.

OCONOMOWOC, WIS.—It is proposed to grant a franchise to the Milwaukee Light, Heat and Traction Company to construct and operate an electric railway. C.

REDWOOD CITY, CAL.—Hall C. Ross, of the firm of Ross & Ross, attorneys, has applied for a single or double track electric railway franchise for this city. A.

PORTLAND, ORE.—The Oregon Electric line will this year spend $2,225,000 in building fifty-seven additional miles of electric railway in the Wilamette Valley. A.

FORT SMITH, ARK.—Work has been started on the new car line extension to the river and the suburbs. It is reported that cars will be running in a few weeks.

JANESVILLE, WIS.—The Janesville Street Railway Company has been placed in the hands of W. H. Lemons and Wm. Murphy, superintendent of the line, as receivers.

PENDLETON, ORE.—The Pendleton Railroad System will shortly proceed with the establishing of its traction system here. A contract has been closed for fifty-two miles of steel. A.

MINNEAPOLIS, MINN.—The Minneapolis & Suburban Railroad Company has been incorporated with a capital of $1,000,000 to construct elevated roads between Minneapolis and St. Paul. C.

RED LODGE, MONT.—Citizens have subscribed $5,000 towards the construction of an electric railroad between Billings and Bear Creek and Red Lodge by way of the Clark's Fork valley towns. C.

LOS ANGELES, CAL.—A contract has been let by the Pacific Electric Company for its extension from Pillsbury to Olinda. The contract provides that the line will be completed, ready for operation, in ninety days. A.

STOUGHTON, WIS.—The Stoughton city council has granted the Cincinnati Construction Company a six-months' extension of its franchise to build the proposed interurban between here and Madison. M.

BRANFORD, CONN.—It is reported that the Shore Line electric railroad which will connect Saybrook with the Stony Creek branch of the electric road, will be in operation on Decoration day.

PASADENA, CAL.—Horace M. Dobbins, president of the Pasadena Rapid Transit Company, announces that work will soon begin on an electric line which will run from Los Angeles to Pasadena in ten minutes. A.

FULLERTON, CAL.—Grading has been started on the twelve-mile cut-off of the Pacific Electric Railway from La Habra Valley east to a point near Yorba. The new road will pass near the Olinda oil wells. A.

WASHOUGAL, WASH.—The North Bank Railroad officials have organized the Clarke County Development Company the object of which is to complete the power plant of the Washougal River and to construct a street car line from Mt. Pleasant Landing through Washougal and Camas to Vancouver. A.

BATAVIA, ILL.—According to an announcement recently made by an official of the Aurora, Chicago and Elgin Railroad Company, the powerhouse here is to be increased in capacity. The plant is now equipped to the extent of 2,500 kilowatts, and to that power will be added 6,000 kilowatts. This will make a total of 8,500 kilowatts, thus more than tripling the capacity.

ROCKPORT, IND.—The work of surveying the extension of the Evansville Electric Railway Company's line from Rockport to Grandview in Spencer county, was begun March 14. The work of constructing the line will begin in a few weeks. A subsidy was voted the road about two years ago and the object is to secure the subsidy by a strict compliance with the order. S.

MORRISTOWN, N. J.—The Morris County Traction Company has completed arrangements for the electrification of the steam railroad between Morris Plains and the State Insane Hospital. Within a few days a car to operate on the road is expected to arrive, and the material for the poles and wires is already here. Work on setting the poles and stringing the wires has also started.

CRAWFORDSVILLE, IND.—Steps have been taken by a New York syndicate to secure a right-of-way for a traction line from this city to Danville, Illinois. This line, when built, will not only pierce the coal fields and touch the Shades of Death, a very popular summer resort, but will form the connecting link for through trolley service from St. Louis to eastern Ohio and New York points by way of Indianapolis.

TEMPLE, TEXAS.—The interurban electric railway of the Belton-Temple Traction Company running between Temple and Belton will be sold under decree of the federal court by the receiver, W. G. Haag, on May 3. The foreclosure proceedings is a friendly action on the part of the bondholders who will buy in the property. The bonds are held by a syndicate of Pennsylvania men who will, it is said, not only improve the existing line but will build an extension to Waco, and probably also to Austin. D.

SCOTTSBURG, IND.—Official announcement has been made that work will begin on the Cincinnati, Madison and Western Traction Company's line between this city and Madison, May 1. John E. Greeley, president of the company, says that the new line will be equipped similar to that of the Indianapolis and Louisville Traction Company to be operated by 1,200 volts direct current. He also stated that the plant is to secure power from the Scottsburg power house to operate the new road. S.

MEMPHIS, TENN.—The indications now are that Fort Smith, Ark., will soon have two interurban railway lines. The Van Buren, Fort Smith and Western Interurban Railroad Company is constructing a line from Van Buren to Fort Smith. It is announced that the Citizens' Electric Company, of Wilburton, Ok., will connect Fort Smith with sertain cities across the state line, including Wilburton, Patterson and Lutie. It is also stated that the road will be extended west from Wilburton to McAlester, Ok.

OGDEN, UTAH.—The Ogden Rapid Transit Company is making an installation which promises to be of interest. In its hydroelectric plant is an alternator coupled to the shaft of a turbine. This turbine has considerably more power than is required for the alternator, so the company plans to couple a 300-kilowatt, 550-volt Allis-Chalmers generator to the end of this alternator shaft. This additional unit will require extensions to the switchboard, and these will also be furnished by Allis-Chalmers Company.

SAN FRANCISCO, CAL.—The Board of Supervisors has passed resolutions calling on the city attorney to secure from the Attorney General of California the necessary permission to begin suit for the forfeiture of the Market Street portion of the franchise held by the United Railroads of San Francisco under the name of the Sutter Street Railroad Company, and for the forfeiture of a number of franchises held by the United Railroads of San Francisco in various parts of the city, which it is thought may have been forfeited by non-use since the great fire. A.

TELEPHONE AND TELEGRAPH.

(Special Correspondence)

WITTENBERG, WIS.—The Wittenberg Rural Telephone company has been organized here with a capital stock of $3,010. The incorporators are O. B. Haen, W. A. Findahl and P. C. Schletter.

ENGLEWOOD, N. J.—The Central Home Telephone and Telegraph Company has been incorporated with a capital of $20,000, to operate telephone and telegraph lines. The incorporators are John Heck, Westwood, N. J.; Garrett Z. Demarest, Demarest, N. J.; Le Roy Vander Burgh, Hackensack, N. J.

HARMONY, ME.—The Harmony & Wellington Telephone Company has been incorporated for the purpose of conducting, operating and maintaining telephone lines in Harmony and Wellington. The capital stock is $5,000, and officers are President, A. H. Willis and Treasurer, S. W. Herrick, both of Harmony.

SACRAMENTO, CAL.—The Pittsburg syndicate has a company of linemen in the field building a private telephone line which is to extend over all its holdings. The line begins at Willows and extends to the Headgate, St. John and Hamilton City and is completed as far as Glenn. This line connects with all construction camps.

DENVER, COLO.—The Tri-State Telephone and Telegraph Company was incorporated recently with $1,000,000. The incorporators are officers in the Colorado Telephone Company. The object of the new company is to take over several companies in New Mexico and construct a new system which will connect Denver with El Paso and other points.

BOWLING GREEN, OHIO.—A plan is being developed here having for its object the turning over to the Home Telephone Company all of the local Bell telephones in Wood county. The Bell will then connect up with the local stations for long distance work. It is understood that the Federal Telephone Company will still retain its rights for long distance service. H.

PADUCAH, KY.—The Paducah Home Telephone Company, valued at $250,000, was purchased a short time ago by the Central Home Surety Company, of Toledo, O., for $50,000, the minimum price set by the court. It was sold by Col. J. D. Powers, of Louisville, special commissioner. The purchasing company held the bonds of the Home company. Manager S. L. Pake says the purchaser will continue the business.

RAVENA, N. Y.—The State Telephone Company of this place, recently incorporated with a capital stock of $10,000, will absorb the Ravena and Medway Telephone Company. The change was desired by the stockholders of the latter company because of the limited territorial rights. The increased capital stock, the old company having only $5,000, will enable the concern to go ahead with the improvements planned, chief among them being the stringing of a cable from Holliday's corner in Ravena to Main street, Coeymans. The Ravena and Medway Telephone Company serves about forty square miles.

ELECTRICAL SECURITIES.

The recent depression of the stock market may be ascribed to a number of causes. First in importance seems to be the congestion of new capital issues, threatening the success of financial plans of the railroads for the carrying forward of projects of improvement. The abrupt decline in the price of the new Atchison convertible bonds when first offered in the market to a price that almost wiped out the value of the subscription rights to stockholders was the salient features in the bond market. One effect was to check the foreign demand for new bond issues, which had afforded important relief to the heavy obligations of the New York money market to foreign markets by reason of the current unfavorable trade balance. The effect was perceptible in the foreign exchange market, which was influenced also by the heavy requirements pressing on the London money market.

March passenger recipts of the Chicago Railways Company, partly estimated, were $1,091,000, or eleven per cent increase.

The Southside Elevated directors, it is announced, intend to resume the three per cent dividend basis next July.

Daily average traffic for March on the Northwestern Elevated was 124,208 passengers, or nearly seven per cent increase.

Current earnings and prospects of the Edison Electric Illuminating Company of Boston are said to justify hopes that the stock will be placed on a twelve per cent basis before long. Beside the regular ten per cent, the company has paid extra dividends of one per cent for the last two years.

The Governing Committee of the New York Stock Exchange has approved the listing of the following securities: Syracuse Lighting Company—$500,000 additional first mortgage five per cent fifty-year coupon bonds, due 1951, making the total amount listed to date $2,500,000. New York Telephone Company—$12,500,000 first and general mortgage thirty-year four and one-half per cent bonds, due 1939, Nos. M 1 to M 12,250, inclusive, for $1,000 each, and Nos D 1 to D 500, inclusive, for $500 each, and £2,500,000 of said bonds, Nos. E 1 to E 5,000, inclusive, for £200 each, and Nos. C 1 to C 15,000, inclusive, for £100 each. In dealings in pounds sterling bonds $5 shall be the equivalent of £1 sterling.

DIVIDENDS

American Power and Light Company, quarterly dividend of one and one-half per cent on the preferred stock, payable April 1.

Northern States Power Company, quarterly dividend of one and three-fourths per cent upon the preferred stock, payable April 15.

Philadelphia Company, quarterly dividend of one and one-half per cent on common, payable May 2.

Standard Underground Cable Company, quarterly dividend of three per cent, payable April 11.

Twin City Rapid Transit Company, quarterly dividend of one and one-half per cent on common, payable May 2.

NEW YORK.	April 4.	Mar. 28.
Allis-Chalmers common	10	10¼
Allis-Chalmers preferred	36½	58½
Amalgamated Copper	74⅞	77¾
American Tel. & Cable	*80	*80
American Tel. & Tel.	134⅜	140¾
Brooklyn Rapid Transit	76⅞	77⅝
General Electric	149	152
Interborough-Metropolitan common	22¼	23⅝
Interborough-Metropolitan preferred	57¼	55½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	87	88¾
Mackay Companies (Postal Telegraph and Cables) preferred	77⅞	77
Manhattan Elevated	136½	136½
Metropolitan Street Railway	18⅝	15
New York & New Jersey Telephone	123	123½
U. S. Steel common	82⅞	84½
U. S. Steel preferred	119	119⅝
Western Union	72	73¾
Westinghouse common	64½	68½
Westinghouse preferred	115	130

BOSTON.	April 4.	Mar 28.
American Tel. & Tel.	134⅜	140¾
Edison Elec. Illuminating		255
General Electric	149	152
Massachusetts Electric common	18	17
Massachusetts Electric preferred	84½	84½
New England Telephone	135	137
Western Tel. & Tel. Common	16½	16
Western Tel. & Tel. preferred	87	87

PHILADELPHIA.	April 4.	Mar. 28.
American Railways	45	45
Electric Company of America	12	12
Electric Storage Battery common	60	61½
Electric Storage Battery preferred	60	61½
Philadelphia Electric	15¾	15⅞
Philadelphia Rapid Transit	22	22⅛
Philadelphia Traction	87	87
Union Traction	49¼	49¼

CHICAGO.	April 4.	Mar. 28.
Chicago Railways, Series 1	101	100
Chicago Railways, Series 2	30	31
Chicago Subway	2¾	2¾
Chicago Telephone	132	132½
Commonwealth Edison	117	116½
Metropolitan Elevated common	16	16
Metropolitan Elevated preferred	52	51½
National Carbon common	115	114
National Carbon preferred	121	121

PERSONAL MENTION.

CAPT. W. L. CANDEE, president of the Okonite Company, is taking a well-deserved rest with Mrs. Candee in Bermuda, and will probably remain there until May.

JAMES T. ROSS, for the past eight years consulting engineer of the Toledo Railways and Light Company and numerous interurban lines has resigned to accept a position as engineer under the commissioner of railways at Cleveland.

H. L. BRINTNALL, formerly of Saginaw, Mich., and one of the delegates to the first convention of the National Electric Light Association, is now visiting in Chicago, and expects to attend the anniversary convention of this Association at St. Louis, next month.

FRANK N. ROBERTS, widely known among the telegraphers of the country, and for several years chief operator in the Chicago district for the Postal Telegraph Company, was promoted to the position of traveling traffic supervisor, with headquarters at New York. Thomas N. Powers succeeds to the chief operatorship.

WILLIAM H. HODGE has been retained by H. M. Byllesby & Company of Chicago as the head of their new publicity department made necessary by their increased business. Mr. Hodge was formerly managing editor of the monthly magazine, *Public Service*, and is a specialist in publicity work for utility companies.

O. C. ROOS, formerly technical expert with the Great Lakes Radio Telephone Company and recently expert in connection with the work of Dr. Fessenden, has been appointed wireless engineer for the United States War Department in the Philippine Islands under the Bureau of Insular Affairs. Mr. Roos has had a wide experience, and is an expert of high degree in both the theoretical and practical phases of radio-communication.

MAX W. ZABEL announces that he has increased the facilities at his office, 1362-3 Monadnock block, and is better prepared than ever before as attorney and counsellor-at-law to properly undertake patent, trademark, and copyright causes. Mr. Zabel graduated from the electrical engineering course of the University of Wisconsin in 1898, and is able to give special attention to the technical details involved in the proper prosecution of American and foreign patents, trademarks and copyrights.

JAMES JEFFREY, formerly auditor, secretary and assistant manager of the William Mueller Company, Blaney, Mich., producers and dealers in cedar ties and poles, is now located in Chicago, making his headquarters at 1315 Granville Avenue. His association with the above company for the past seventeen years has brought him into touch with the leading consumers and will prove a valuable asset in any manufacturing company's branch office which he may open in Chicago. His experience covers the ground in all phases from the stumpage cost to the finished article.

HARRISON G. THOMPSON, formerly with the Railway Department of the Westinghouse Storage Battery Company, and for a long time associated with the Safety Car Heating and Lighting Company, has accepted a position in the sales organization of the United States Light and Heating Company. Mr. Thompson has been long identified with the railway business, both in the car lighting and storage battery fields. He will make his headquarters at the New York Office, Thirty Church Street, New York, although it is probable that his duties in connection with the railway department will take him all over the country.

HARRY W. TURNER has resigned his position as general manager of the Butte Electric Light and Power Company of Butte, Mont. Mr. Turner finds it necessary to devote his time and attention in the future to his private interests in Montana and Washington, and is unable to give the attention and time to the electric company which are necessary with the growing business. Mr. Turner has been in charge of the present electric company and its predecessor for twenty-three years. The present company was formed from a consolidation of several previously in the field, one of which had been under Mr. Turner's management. After the consolidation of the various companies, Mr. Turner took charge at once and has been general manager ever since. Mr. Turner will retain the vice-presidency of the company and retain his stock interests in the concern. He will be succeeded as general manager by Max Hebgen, who has been superintendent of the company for several years.

OBITUARY.

THOMAS B. JEFFERY, president of Thomas B. Jeffery & Company, automobile manufacturers, died suddenly at Pompeii, Italy, while on a tour of Europe. Mr. Jeffery started in the manufacture of astronomical instruments in Chicago and later took up the manufacture of bicycles. Afterward he became interested in the automobile manufacturing business. Mr. Jeffery is survived by his wife, two sons and two daughters.

JOSEPH W. WOODS, a veteran telegraph operator, said to be the first man in New York to get the news over the wires that Fort Sumter had been fired upon at the outbreak of the Civil War, succumbed to an attack of pneumonia in a New York hospital on March 27, at the age of seventy-two years. Mr. Woods was in the service of the Western Union Telegraph Company for more than half a century, retiring in 1905. He was unmarried and two sisters, residing in St. Louis, are his only living relatives. Mr. Woods was born in Cambridge, Mass., and went to New York as a boy. He became an operator for the Western Union within a few years, and was first in its marine service. For a number of years he was stationed at Fire Island, when sight by telescope was the first news to be had of incoming craft. Later he was transferred to the ship news office at the Battery, and from there went into the commercial service. He was manager of a number of offices in New York city city, and fifteen years before his retirement took charge of the office in Church Street, from which he retired.

PROPOSALS.

POST OFFICE, LANDER, WYO.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until May 2 for the construction (including plumbing, gas piping, heating and ventilating apparatus, electric conduits and wiring, and standard clock system) of the United States post office at Lander, Wyo., in strict accordance with drawings and specifications, copies of which may be had from the custodian of site at Lander, Wyo., or at the Supervising Architect's office.

POST OFFICE, GREENCASTLE, IND.—The office of the Supervising Architect, Washington, D. C., will receive bids until April 20, 1910, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Greencastle, Ind., in accordance with the drawings and specifications, copies of which may be obtained from the custodian of site at Greencastle, Ind., or at the Supervising Architect's office.

POST OFFICE, CHARLESTON, W, VA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until May 4 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system) of an extenson, remodeling, etc., to the United States Post Office and Court House at Charleston, West Virginia, in accordance with drawings and specifications, copies of which may be obtained from the custodian, or at this office at the discretion of the Supervising Architect.

LIGHT AND POWER PLANT.—The office of Constructing Quartermaster, Fort Sill, Okla., will receive sealed proposals (in triplicate), until April 13, 1910, for an electric light and power plant and electric lighting system at Fort Sill. Specifications, blueprints, and further information will be furnished on application to Captain David L. Stone, Constructing Quartermaster. Certified check for $10 will be required to insure return of plans, etc. Check will be returned upon return of plans, etc., to this office. proposals should be indorsed "Proposals for Electric Light and Power Plant or Electric Lighting System."

NEW PUBLICATIONS.

MINERAL RESOURCES OF THE UNITED STATES.—Under this title the United States Geological Survey, through George Otis Smith, director, has published two bound volumes dealing with the mineral resources of the United States. Volume I is devoted to metallic products and Volume II to nonmetallic products.

BULLETIN OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—The Massachusetts Institute of Technology has issued a bulletin containing a schedule of courses for the summer session. The courses mentioned are available for all students or non-students who are prepared for the work. Several valuable laboratory courses are offered.

OPINIONS OF PUBLIC SERVICE COMMISSION—Under this title the Public Service Commission, Second District, State of New York, is publishing two opinions, one in the matter of track conditions and proposed switches of two local roads and the other in the matter of a local company charging a passenger excess fare for failing to purchase a ticket before boarding the train.

JOURNAL OF THE WORCESTER POLYTECHNIC INSTITUTE.—The March issue of the Journal of the Worcester Polytechnic Institute contains an interesting collection of experiences written by graduates who entered the testing department of the Westinghouse Electric and Manufacturing Company. A very good idea of the course may be obtained by reading these. There are a number of other excellent articles.

UNIT COAL AND THE COMPOSITION OF COAL ASH, by S. W. Parr and W. F. Wheeler, is issued by the Engineering Experiment station of the University of Illinois as Bulletin No. 37. This is a report of a series of experiments on coal, together with a tabulation of calculated values of unit coal for Illinois, Ohio, and other coal regions of the United States. The results show great constancy in the value of unit coal for any given mine or region, notwithstanding the fact that the value of the natural coal as mined may vary between wide limits.

THE DENVER COMPANY SECTION OF THE N. E. L. A. has published its March bulletin containing a number of interesting papers. One of these, entitled "Selling a Sign to a Garage," appears in the form of a dialogue which took place at one of the meetings of the executive council, between Mr. Connors and Mr. Evans of the Denver Gas and Electric Company. The article of most vital interest is one stating the decision of the section to have an electric show in Denver some time during the coming fall. A stock company is to be organized, and a large part of the stock has already been subscribed.

NEW INCORPORATIONS.

KENYON, MINN.—Martin Hjermstad, August Johnson and others have incorporated the Kenyon Electrical Manufacturing Company. C.

MINNEAPOLIS, MINN.—Harry Reed, Manley Fosseen and J. S. Harley have incorporated the Minneapolis Automatic Electric Signal Company with a capital of $200,000. C.

NEW YORK, N. Y.—The Lord Manufacturing Company has been incorporated to manufacture and deal in electrical appliances. The incorporators are: Frederick W. Lord, William R. Garton and Frederick W. Erickson, New York city.

NEWARK, N. J.—The Safety Electric Company has been incorporated to manufacture electric motors, dynamos and other electrical machinery, with a capital of $125,000. The incorporators are: C. P. Taylor, C. H. Fay, Scott German, Newark.

CHICAGO, ILL.—The Subway Telephone Company has been incorporated with a capital of $100,000 for the purpose of manufacturing and dealing in electrical appliances and machinery. Joseph Harris, Sanford F. Harris and Albert E. Wilson are the incorporators.

GREENWICH, CONN.—The Lamma Manufacturing Company has been incorporated with a capital of $10,000 by J. S. Keith, of New York, G. H. Rees, of Brooklyn, and James Guargiia, of Hoboken, N. J. The company will manufacture friction braid and tape for insulation purposes.

NEW YORK, N. Y.—The Studebaker Vehicle Company has been incorporated with a capital of $8,600,000, of which $3,500,000 is to be first preferred cumulative 7 per cent and $1,500,000 second preferred 7 per cent stock. The directors are Frederick P. Delafield and Scott Brown, of New York, Clement Studebaker, Jr., Scott Brown, Frederick S. Fish of South Bend, Ind., and Frederick Longfellow. On behalf of the Studebaker company, J. P. Morgan and Company, acting as brokers, purchased the E. M. F. company, automobile manufacturers of Detroit. Morgan and Company have no personal interest in the transaction.

INDUSTRIAL ITEMS.

THE McROY CLAY WORKS, Chicago, Ill., is sending out blotters with a calendar of the month of April and an appropriate motto.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has issued a price list of its electrical supplies. The list contains prices on all standard goods carried by the company.

THE SANBORN-MARSH ELECTRIC COMPANY, Indianapolis, Ind., announces that hereafter it will be known as the Sanborn Electric Company, with headquarters at 115 North Illinois Street, Indianapolis.

THE HABIRSHAW WIRE COMPANY, New York, N. Y., supplied all the wire which was used in the New Theatre. This theatre, which was lately built in New York city, is ideally equipped in every way.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has received a large number of orders for direct current generators and direct current motors. Among the latter are several mill motors for the Alliance Machine Company, of Alliance, Ohio.

THE COLUMBIA METER COMPANY, Indianapolis, Ind., is enclosing with a letter to its customers the third monthly postcard. This is imprinted with an attractive picture and calls attention to the construction of the Columbia integrating wattmeter.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainfield, Conn., has issued its April number of "Trumbull Cheer" which contains the usual number of Trumbull witticisms and some good points on salesmanship A number of switches and cutouts are illustrated.

THE KUHLMAN ELECTRIC COMPANY, Elkhart, Ind., reports having furnished the low voltage transformers for the first installation of ten volt tungsten lamps in the United States. The company has just received an order for eighty-four transformers for another installation.

THE DUPLEX METALS COMPANY, New York, N. Y., is sending out blotters with the statement that the 342 companies now using 4,850,000 pounds of copper-clad steel wire are saving $350,000 by so doing. The blotter has in one corner the company trade mark showing a cross section of the copper-clad wire.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Chicago, Ill., has mailed a folder advertising its magneto telephone sale and advising customers to "Get yours now." The central energy wall type, wide battery and narrow box types, are illustrated and are features of this folder. One of the pages of the folder is made up of two detachable postal cards for the convenience of those ordering telephone sets.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., in a recently issued booklet describes and illustrates a line of candelabra and canopy switches. The former switch is of the push-button type and the latter of the push-and-pull type and both are approved and listed by the Underwriters' National Electric Association. The several illustrations show the design and construction of these switches and also show their various applications.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., has mailed to the trade a folder on the "New Flexduct." The interweaving of the "New Flexduct" is shown in one of the illustrations, while another shows a section with a knot tied in it. The "New Flexduct" is described as being 100 per cent flexible. As the folder is printed in red and blue, the distinctive red, white and blue tape with which the "New Flexduct" coils are tied is shown to advantage.

W. & L. E. GURLEY, Troy, N. Y., manufacturers of civil engineers' and surveyors' instruments and physical and scientific apparatus, have ready for distribution an attractively bound catalogue devoted to the latter apparatus, which includes nearly every known accessory for the physical, chemical, electrical and mechanical laboratory. The catalogue contains numerous illustrations. In connection with this catalogue the company is sending out a special booklet describing Gurley test-weights for testing scales.

THE AMERICAN SHIP WINDLASS COMPANY, Providence, R. I., has tabulated and printed in bulletin form the results of tests made on boilers equipped with Taylor gravity underfeed stokers. Among the plants tested was the Waterside station of the New York Edison Company, and in connection with the tables, two curves are given showing the relation of efficiency to capacity. In the case of the Nashua Manufacturing Company's plant, the increase in economy brought about by the use of a Taylor stoker plant is shown to be nearly seventeen per cent.

THE KELLOGG SWITCHBOARD & SUPPLY COMPANY, Chicago, Ill., is issuing a return postal card calendar illustrating a subscriber telephoning over one of their desk stands. The halftone engraving brings out clearly the symmetrical lines of the Kellogg telephone and indicates that telephoning over Kellogg apparatus is a pleasure. The calendar is being sent out with a return card attached, which allows the recipient conveniently to send for desk stand prices or bulletins on telephones and switchboards. The illustration is made in two colors and shows a pretty girl talking over a desk telephone held in her hand. Below the halftone plate is a line drawing of a rural scene, a telephone pole line stretching away in the distance, past a prosperous looking farm house. This postal calendar may be secured promptly by addressing the company.

THE WESTERN ELECTRIC COMPANY has recently issued its bulletin No. 5360 which takes up the subject of Hawthorn small power motors. The bulletin describes very completely types of small motors, both alternating and direct current, ranging from one-sixth horsepower to one-thirtieth horsepower, suitable for various purposes, such as buffing and grinding wheels, sewing machines, meat grinders and other household machines which require little power to operate. The direct current motors are built for operation on 110 and 220 volts at various speeds from 1,100 to 3,400 revolutions per minute. The alternating current small motors are built for 110 and 220 volts at sixty, forty-five and twenty-five cycles, single two and three-phase, at the several synchronous speeds, in a full line of fractional horse-power ratings ranging up to one-quarter horsepower.

ALLIS-CHALMERS COMPANY reports that its gas engine business continues to increase and at present the full capacity of the gas engine shop is required for gas engines alone. Some of the recent sales are two eighteen by twenty-four engines with generators to the Ware County (Ga.) Light and Power Company; one eighteen by twenty-four engine and generator to the American Car and Foundry Company for its plant at Huntington, W. Va., three eighteen by twenty-four engines and generators to the Guanica Portland Cement Company for its new plant at Alsens, N. Y., and three twenty-four by thirty-six engines and generator to the Alpha Centrale Company for a sugar mill in Porto Rico. There are many other propositions under consideration and it is apparent that the gas engine is now fully as acceptable for power purposes as any other type of prime mover.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., will install a 750 kilowatt low pressure Westinghouse steam turbine in to the power plant of the Corr Manufacturing Company, East Taunton, Mass., to utilize the exhaust of their Corliss reciprocating engines. The steam supplied the turbine is at nearly the pressure of the atmosphere, fifteen pounds absolute, and the turbine is served by a Westinghouse-Leblanc condenser which maintains a vacuum of about thirty-eight inches. The generating apparatus driven by the low pressure turbine is a 940-kilovolt ampere, turbine type alternator, furnishing three phase, sixty cycle current at 600 volts. Distribution lines at this voltage supply a number of 100 horsepower motors in the weave sheds, serving as economical auxiliaries to the older system of belting and line-shaft transmission from the engine to the machines driven.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has recently published a number of on motors, lighting and kindred subjects and is mailing these to parties interested. Bulletin No. 4716 describes several types of Thomson prepayment watthour meters, which are exceedingly simple, and strong enough to withstand the rough treatment incidental to transportation and rough use. These meters are arranged for use with either a separate or combined prepayment device. They are made for two and three-wire service, and 100 to 120, or 200 to 240 volts, direct or alternating current. This publication contains dimension of the meters and diagrams of connection. In Bulletin No. 4717 there appears a description of the flame arc lamp, used for lighting streets and large interiors. The lamps described in this publication are designed to operate on 110, 220 and 550 volts in different combinations. Apropos of the coming season, bulletin 4719 illustrates and describes electric fans for 1910. Bulletin 4720 describes in considerable detail the company's steam and air flow meters. The recording and indicating steam and air flow meters described in this publication provide the means for obtaining such information. This bulletin should be of interest to all central station managers. Bulletins 4721 and 4722 describe Thomson direct current watthour meters and electrically driven cement plants.

DATES AHEAD.

Missouri Electric, Gas, Street Railways and Water Works Association. Next convention, Jefferson City, Mo., April 14, 15 and 16.

Florida Electric Light and Power Association. Next meeting Tampa, Fla., April 21.

Iowa Electrical Association and Iowa Street and Interurban Railway Association. Annual convention, Sioux City, Ia., April 21, 22 and 23.

Arkansas Association Public Utilities Operators. Annual convention, Pine Bluff, Ark., April 27, 28 and 29.

Southwestern Electrical and Gas Association. Annual meeting. Beaumont, Tex., May 10, 1910.

Ohio Mechanical, Electrical and Steam Engineers' Association. Next meeting, Cincinnati, O., May 10.

Oklahoma Public Utilities Association. Next meeting, Sapulpa, Okla., May 9, 10 and 11.

National Electric Light Association. Annual convention, St. Louis, Mo., May 23-28.

Maine Electrical Society. Next meeting, Portland, Me., May 25.

Michigan Electrical Association. Annual convention, Port Huron, Mich., August 16, 17 and 18.

Colorado Electric Light, Power and Railway Association. Next convention, Glenwood Springs, Colo., Sept. 21, 22, and 23.

Directory of Electrical and Allied Engineering and Scientific Societies

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Wachtung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-inth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One Hundred and Sixteenth Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of Lighting, Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, H. F. Frasse, Edison Electric Illuminating Company, Brooklyn, N. Y.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Perry-Payne Building, Cleveland, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick Streets, San Francisco, Cal.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Confederation Life Building, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 157 Bay Street, Toronto, Canada.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis, Ind.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, F. S. Hickok, Marquette Building, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 25 West Forty-second Street, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Avenue, Kansas City, Mo.

ELECTRICAL TRADES' ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK. (Member National Electrical Trades Association.) Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West Thirty-ninth Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Mayer Building, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. President and acting secretary, C. C. Perry, Indianapolis Light and Heat Company.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allan J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

IOWA ELECTRICAL ASSOCIATION. Secretary , W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpin, Henderson, Ky.

MAINE ELECTRIC ASSOCIATION. Secretary, F. D. Gordon, Auburn, Me.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary and treasurer, A. P. Biggs, Detroit, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, D. C. Gordon, Little Falls, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.
MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER-WORKS ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.
MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Geoorge W. Schwerer, Windsor, Mo.
MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.
NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.
NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, O.
NATIONAL ELECTRICAL CONTRACTORS, ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.
NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago, Ill.
NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, F. M. Tait, 124 East Fourth Street, Dayton, Ohio, Executive secretary, T. C. Martin, 33 West Thirty-ninth Street, New York city.
NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ware, Monadnock Block, Chicago, Ill.
NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.
NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.
NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State Street, Boston, Mass.
NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, C. H. Hodskinson, Boston, Mass.
NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass.
NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Huy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.
NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.
NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.
NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract, Building, Seattle, Wash.
OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.
OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.
OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof F. E. Sanborn, Ohio State University, Columbus, Ohio.
OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.
OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.
OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city.
ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, Roy M. Van Vliet, Monadnock Block, Chicago, Ill.
PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.
PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa.
PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.
PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.
PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo.
PITTSBURG ELECTRIC BOOSTER CLUB. Secretary O. R. Rombach, Recording Wattmeter, 919 Liberty Avenue, Pittsburg, Pa.
RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa.
SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city.
SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, 96 Franklin Street, South Framingham, Mass.
SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. H. H. Norris, Cornell University, Ithaca, N. Y.
SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.
SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.
STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.
TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.
UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk Street, Boston, Mass.
VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.
VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.
VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.
WESTERN SOCIETY OF ENGINEERS. Secretary, J. H. Warder, Monadnock Block, Chicago, Ill.
WESCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.
WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary , J. C. Crowley, Jr., Superior, Wis.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) March 29, 1910.

953,018. ALTERNATING-CURRENT MOTOR. Hans Alexander, Berlin, Germany, assignor to General Electric Company. Filed July 21, 1909. Describes a polyphase commutator-type motor

953,021. ELECTRIC SWITCH. Frank E. Case, Schenectady, N. Y assignor to General Electric Company. Filed Jan. 11, 1908. A combination of a power-operated switch with a manually-operated switch, etc.

953,028. AUTOMATIC SWITCH MECHANISM. Alfred C. Griscom, New York, N. Y. Filed Sept. 26, 1907. Electrical devices are arranged in a main motor circuit (which includes separable contacts) for controlling a shunt circuit around the contacts, and can themselves be shunted by automatic devices.

953,029. ELECTRIC SMELTING-FURNACE. Eugen A. A. Gronwall, Axel R. Lindblad and Otto Stalhane, Ludvika, Sweden. Filed May 1, 1906. A form of electric transformer furnace.

653,030. TRANSFORMER-FURNACE. Eugen A. A. Gronwall, Axel R. Lindblad and Otto Stalhane, Ludvika, Sweden. Filed March 29, 1907. Comprises an electric transformer having a core composed of a frame having a transverse leg, the furnace having an endless groove for the material to be treated that is formed partly of a channel or groove arranged close around the said leg of the transformer forming a nearly closed circuit.

953,036. SINGLE-PHASE-MOTOR CONTROL. George H. Hill, Schenectady, N. Y., assignor to General Electric Company. Filed Sept. 13, 1907. The method of operating a single-phase motor of the commutator type consists in connecting it as a shunt motor at starting and when it has started changing the connections to cause it to operate with series characteristics.

953,082. SELECTIVE RINGING SYSTEM FOR PARTY-LINE TELEPHONES. Fred E. Winslow, Des Moines, Iowa. Filed May 2, 1908. A direct-current ringer is included in a grounded branch connected to the main line at one substation; a pulsating-current ringer is included in a grounded branch connected to the main line at another substation; and an impedance coil is interposed in the grounded branch which includes the direct-current ringer.

953,084. DOUBLE-THROW MOTOR-STARTING SWITCH. Sears B. Condit, Jr., Brookline, Mass. Filed Jan. 21, 1909. A multi-throw switch, comprises separated contacts, a reciprocatory swinging contact-maker, and operating means therefor, etc.

953,102. TELEPHONE-TRANSMITTER. Philip G. Randall, Malden, Mass. Filed Dec. 19, 1907. The transmitter includes means for permitting the use of increased battery power and obtaining clearer and louder effects in the transmission of sounds.

953,107. MICRO RECEIVER OR TRANSLATOR. Pietro Stragiotti, Hurley, Wis., assignor of one-fourth to Griffith Thomas, one-fourth to Joseph Vercellini, and one-fourth to Frank Marta, Hurley, Wis. Filed Aug. 11, 1908. A differential microphone.

953,109. AUTOMATIC ELECTRICAL SIGNAL FOR RAILWAYS. William Tullock, Denver, Colo., assignor of one-tenth to William J. Thompson, one-tenth to Thomas McKernan, Denver, Colo., one-fifth to William M. Laurie, one-fifth to Thomas Phillips, and one-fifth to Harry Russell, Leyden, Colo. Filed Feb. 16, 1909. A make-and-break device in the track is operated by a passing train.

953,188. TELEPHONE SYSTEM. Alfred H. Weiss, Chicago, Ill.,

assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed July 24, 1905. A cord circuit (associated with a battery) has tip and sleeve strands terminating in suitable plugs and adapted to form electrical contact with the contacts of the spring jacks, etc.

953,191. SUBMARINE MINE. Axel E. T. Bergström, Stockholm, Sweden. Filed July 31, 1908. An iron vessel passing in the vicinity of the mine causes an electric circuit to close and explode the mine.

953,202. DYNAMO-ELECTRIC MACHINE. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed April 1, 1908. A synchronous alternating-current machine has a field magnet with evenly spaced poles, a slotted armature core, and an armature winding comprising coils of uniform pitch carried in the slots, the slots being evenly spaced and slightly greater in number than required to contain the coils.

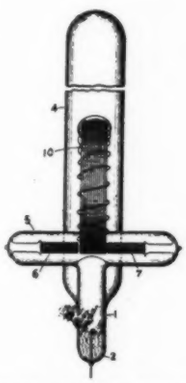
953,207. TROLLEY-LINE CIRCUIT-BREAKER. John C. King and Thomas J. Reed, Roda, Va. Filed May 6, 1909. Contact is broken by means of a pivotal switch handle bar.

953,218. MAGNETO IGNITION APPARATUS. Charles M. P. Montbarbon, Paris, France. Filed Dec. 11, 1908. A magneto-generator magnet substantially closed as a magnetic circuit but broken as an electric circuit is provided, in combination with an induction coil arranged on the inside of the magnetic circuit.

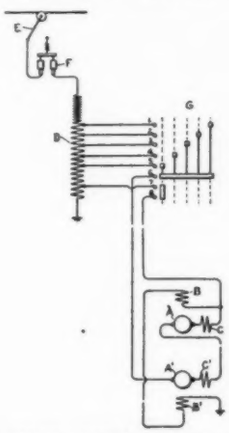
953,219. ELECTRIC MOTOR. Heinrich Muller, Berlin, Germany, assignor to General Electric Company. Filed Aug. 29, 1907. Tow rotatable members are situated side by side, one fastened to and the other free to rotate about the shaft, and a ventilator is driven by the latter member.

953,236. COMBINED CLEAT AND SWITCH FOR HOUSE-WIRING. Howard R. Sargent, Schenectady, N. Y., assignor to General Electric Company. Filed Sept. 19, 1908. A switch has on its casing diametrically opposite lugs containing transverse parallel openings for line conductors, and intersecting openings lengthiwse of the lugs.

953,243. SIGNALING SYSTEM FOR RAILWAYS. Per Utne, New York, N. Y., assignor to The Union Switch and Signal Company, Swissvale, Pa. Filed Sept. 28, 1908. Sets of laminations



953,036.—SINGLE-PHASE MOTOR CONTROL.



953,361.—MERCURY-ARC RELAY.

are secured to the opposite track rails at intervals and embrace the webs and flanges thereof and afford a path for the magnetic flux produced by the signaling current flowing in the track rails; a winding is provided for each set of laminations in which a current is induced by the magnetic flux flowing in the laminations and relay devices are energized from the induced currents in the windings.

953,259. ELECTRIC AUTOMATICALLY-OPERATED GATE. Otto G. De Hoog, Los Angeles, Cal. Filed Nov. 8, 1909. An electric motor is connected to the gate through suitable gearing.

953,301. LIGHTNING-ARRESTER. James C. Seaman, Collinwood, Ohio. Filed Oct. 30, 1907. To choke coils are inclosed in a base of nonconducting materials, the inner ends extending without the base, whereby the coils may be connected in series in a line; a conductor leads from the connection between the coils to a point contiguous to the outer ends of the same; and a grounded terminal is separated from the terminals of the coils and that of the conductor by air gaps.

953,306. ELECTRICAL CONTACT. Walter F. Taylor, Brookline, Mass., assignor to Holtzer Cabot Electric Company. Filed Feb. 5, 1907. A contact for electric apparatus comprises a metal base, tongues stamped out from the metal base, and having their ends bent up, a contact piece proper held on the metal base by the bent-up ends of the tongues clasping the edges of the contact piece, the tongues being stamped out of that part of the metal base which is covered by the contact piece.

953,310. INCUBATOR-HEATER. Charles E. Adair, Buffalo, N. Y., assignor to Cyphers Incubator Company, Buffalo, N. Y. Filed March 11, 1908. The valves for the fluid-circulating system are motor-operated.

953,340. LOCK-OUT DEVICE FOR PARTY-TELEPHONES. Daniel W. Kneisly, Dayton, Ohio, assignor to The Dayton Telephone Lockout Manufacturing Company, Dayton, Ohio. Filed April 27, 1908. The oscillation of a pivoted lever may be regulated to predetermined limits.

953,344. CALL-REGISTER FOR TELEPHONES. John Merckens and Anton J. Herrick, Chicago, Ill., assignors to James E. Plew, Chicago, Ill. Filed Dec. 19, 1904. A tally register comprises a counter member, means for tallying thereon, and a set-back mechanism comprising a magnet operatively connected with the line circuit, operative connections between the armature of the magnet and a counter-actuating member whereby the counter may be set back, and a manually operable member operatively connected with the magnet-controlled member.

953,354. SNAP-SWITCH. George E. Stevens, Lynn, Mass., assignor to General Electric Company. Filed Sept. 16, 1908. A snap switch comprises an insulating base, a stop-plate secured to the base, a rotary spindle, a catch-plate movable transversely of the spindle and co-operating with the top-plate, and a spring connected to the catch-plate and the spindle and operating to retract the catch-plate, turn it angularly and project it into re-engagement with the stop-plate.

953,361. MERCURY-ARC RELAY. John B. Taylor, Schenectady, N. Y., assignor to General Electric Company. Filed September 17, 1907. An electric relay, comprises an evacuated receptacle, a vaporizable cathode and two anodes, and transmitting means for deflecting the arc stream away from one or the other of the anodes.

953,362. CLUSTER-SOCKET. Julius C. Tournier, Schenectady, N. Y., assignor to General Electric Company. Filed July 21, 1908. A spherical insulating base is divided into portions, the upper portion having one or more screw shell contacts secured to its division surface, the lower portion having one or more recesses corresponding to the contacts, a ring of insulating material is screwed on each shell contact; and a yielding annulus is interposed between the ring and the base.

953,366. SINGLE-PHASE COMMUTATOR-MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed January 4, 1908. Inducing and exciting windings on the stator are connected to produce a series characteristic in the motor; a winding on the motor stator is in inductive relation to the inducing winding producing a magnetomotive force at the point occupied by the armature coils when undergoing commutation; connections are provided between the last-mentioned winding and the exciting winding; and a phase converter is included in their connections.

953,369. ELECTRICALLY-CONTROLLED SWITCH. Eugene R. Carichoff, Schenctady, N. Y., assignor to General Electric Company. Filed December 2, 1908. A switch comprises a fixed contact member, a movable contact member co-operating therewith, an actuating member co-operating with the movable contact member, and a magnetizing coil for producing magnetic adhesion between the actuating member and the movable contact member and for magnetically retaining the latter in one extreme position of movement.

953,404. LIGHTING SYSTEM. Magnus Unger, Schenectady, N. Y., assignor to General Electric Company. Filed January 10, 1907. In combination with a circuit and an electric lamp connected across said circuit, are a resistance in series with the lamp, an electromagnet connected across the circuit in series with the resistance, and a vibratory armature for the electromagnet arranged to control a shunt circuit around the resistance.

953,415. SAFETY-SWITCH. Max Fuss, Berlin, Germany, assignor to General Electric Company. Filed April 13, 1906. A form of circuit breaker.

953,420. REVERSE-CURRENT RELAY. Edward M. Hewlett, Schenectady, N. Y., assignor to General Electric Company. Filed September 17, 1907. A relay comprises a coil, two armatures included in the magnetic circuit of the coil (one of the armatures being responsive only to excess current through the coil), and means for polarizing the other of the armatures and thereby causing the coil to attract it when current flows in one direction and to repel it when current flows in the other direction.

953,425. HOODED ELECTRIC LAMP. George E. Miller, Takoma Park, D. C. Filed March 8, 1909. An adjustably self-supporting lamp for illuminating a restricted area comprises a tubular lamp inclosing and supporting member having a restricted exposure opening, and having means by which to develop endwise thrust adapting it to sustain itself in angularly adjustable position between two opposed faces.

953,442. TELEPHONE ATTACHMENT. Thomas W. Small, Cleveland, Ohio, assignor to The Acme Automatic Street Indicating Company, Cleveland, Ohio. Filed September 10, 1907. A telephone has a switchhook, a member adapted to carry the receiver and extend across and bear down on the switchhook, and means for supporting the member in various adjusted positions.

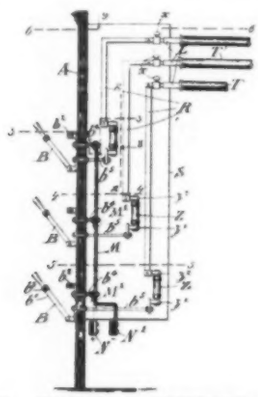
953,466. ELECTRIC SWITCHBOARD. Wallace M. Hyman, New York, N. Y. Filed July 8, 1905. Renewed June 5, 1909. Comprises a face-wall or continuous upright board, a plurality of vertical panels perpendicular to the face-wall or board at the rear thereof, and a plurality of busbars supported by the panels on either side thereof, the busbars on one side being of one polarity and the busbars on the other side of opposite polarity, each of the busbars having one of its ends terminating at the front of the upright board.

953,468. VARIABLE-SPEED-CONTROLLING DEVICE FOR ELECTRIC MOTORS. Samuel H. Keefer, Plainfield, N. J. Filed October 13, 1909. Comprises an actuating member having a constant throw, a series of contracts, a movable switch member capable of engaging the contacts, and a device including a reciprocable bar and means for varying the angle of the bar for connecting the actuating member with the movable switch member for varying the particular contacts engaged by the latter when it is moved.

953,498. COMBINED SPARK-COIL AND INDICATOR. James V. Thorndike, Randolph, Neb. Filed October 23, 1908. A spark coil connected with an electric circuit for increasing the voltage of currents flowing through the circuit; a movable armature is provided for the spark coil; and indicating mechanism is connected with the movable armature and actuated thereby for disclosing when the spark coil is energized.

953,550. TELEGRAPHIC APPARATUS. Herbert E. Powell, East Oakland, Cal. Filed April 29, 1908. A form of telegraph key.

953,574. COOLING OF INCLOSED DYNAMO-ELECTRIC MACHINERY. Paul Amsler, Baden, Switzerland, assignor to Aktiengesellschaft Brown Boveri & Cie., Baden, Switzerland. Filed March 27, 1909. An apparatus for cooling inclosed dynamo electric machinery, consists in a hollow metal foundation, imbricated ribs attached to and within the foundation, and an air-circulating element adapted to circulate continuously the same air through the dynamo electric machine and past the ribs.



953,466.—ELECTRIC SWITCHBOARD.

953,575. ELECTRICAL SIGNALING APPARATUS. Henry W. Aylward, Broklyn, N. Y. Filed Dec. 10, 1908. Comprises a receiving instrument having a plurality of reciprocally movable members, electromagnetic means for moving the members, a crankshaft arranged to be rotated by the members, an indicating member arranged to be moved by the crankshaft, and auxiliary signaling means controlled by switches operated by the reciprocally movable members.

953,579. CLAMP FOR ELECTRIC WELDING MACHINES. George E. Barstow, Lynn, Mass., assignor to Thomson Electric Welding Company, Lynn, Mass. In an electric metal working apparatus, the work-clamping devices have a pivotally mounted member adapted to engage the clamping jaw with the work by a turning movement upon its pivot, and an eccentric forms a pivotal point of support for the member.

953,584. LIGHTING SYSTEM FOR SELF-PROPELLED VEHICLES. Harry J. Bishop, Riverside, and James K. Delano, Jr., Chicago, Ill., assignors to The Kinley Manufacturing Company. Filed May 3, 1909. Comprises a compound-wound generator having the series field winding opposed to the shunt, a lamp circuit adapted to be lighted by the generator circuit, an adjustable circuit adapted to bridge variable numbers of the series windings, and a common switch for closing the lamp and adjustable circuits.

953,598. VAPOR ELECTRIC APPARATUS. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Company. Filed January 14, 1908. An evacuated vessel has a wall composed of a conductor of the second class; an interior electrode is provided in engagement with the inner side of the wall and an exterior co-operating electrode in engagement with the outer side of the wall and in alinement with the interior electrode whereby current to operate the device is conducted into the vessel through the wall when the wall is heated.

953,601. METHOD OF TREATING ELECTRODES. Louis H. Flanders, Edgewood Park, Pa., assignor to Westinghouse Storage Battery Company. Filed February 23, 1909. The method of repasting worn-out storage-battery plates containing some active material, consists in placing the plate to be treated upon a moisture-removing bed, then brushing liquid, containing active material in suspension, through openings in a wall of the plate and removing the plate from the bed after superfluous moisture has been removed from the active material.

953,603. IGNITING SYSTEM FOR INTERNAL COMBUSTION ENGINES. Jacob H. Friedenwald, Baltimore, Md. Filed June 4, 1909. Includes a magneto, jump-spark device, etc., with certain peculiarities in electrical connections.

953,635. WIRELESS TRANSMITTING SYSTEM. John Muth and Christian F. Heinkel, Cleveland, Ohio. Filed September 25, 1908. A system of wireless transmission of electromagnetic waves has a source of power conductively connected to the oscillator circuit and inductively connected with the radiator circuit.

953,640. BATTERY-HOLDER SYSTEM. George L. Patterson, New York, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed March 5, 1909. A combined holder and connector for battery cells.

953,678. TEST-CLIP. Andrew T. Luther and Charles H. Luther, Providence, R. I. Filed April 14, 1909. Comprises a frame, a slide reciprocally supported on the frame, means on the frame for reciprocally supporting the slide a detachable piercing member carried by the slide and adapted to pierce the insulation on an insulated wire and electrically connect the wire to the test clip, and a jaw on the frame adapted to automatically center the wire relative to the piercing member.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired April 4, 1910.

494,562. TELAUTOGRAPH. Elshia Gray, Highland Park, Ill.
494,565. CONTROLLING-SWITCH FOR ELECTRIC MOTORS. Warren S. Hill, Boston, Mass.
494,585. MEANS FOR ELECTRICALLY HEATING CRUCIBLES. Willis Mitchell, Malden, Mass.
494,586. APPARATUS FOR ELECTRICALLY HEATING CRUCIBLES. Willis Mitchell, Malden, Mass.
494,587. ELECTRIC COAL-MINING MACHINERY. Edmund C. Morgan, Chicago, Ill.
494,608. MEANS FOR SWITCHING GENERATORS OR MOTORS IN OR OUT OF CIRCUIT. Nathan VanDenburgh and Frederick H. Loveridge, Chicago, Ill.
494,610. ELECTRIC SWITCH. George W. Webb, Wilkes-Barre, Pa.
494,629. COMMUTATOR-BRUSH FOR DYNAMOS. David W. Dunn, Pittsburg, Pa.
494,657. ELECTRIC METER. Milton E. Thompson, Boston, Mass.
494,705. ELECTRIC-LOCOMOTIVE REGULATION. Rudolph M. Huntee, Philadelphia, Pa.
494, 721. ELECTRIC-RAILWAY TROLLEY. Edward Martyn, Detroit, Mich.
494,739. BRUSH-SUPPORTER FOR DYNAMO-ELECTRIC MACHINES. Axel Elkstrom, Lynn, Mass.
494,750. SWITCH FOR ELECTRICAL CURRENTS. Henry P. Ball, Schenectady, N. Y.
494,762. ELECTRICAL ANNUNCIATOR. John B. Rogers, Washington, D. C.
494,765. MEANS FOR CLOSING AN ELECTRIC CIRCUIT. Harry L. Tyler, Corning, N. Y.
494,781. CIRCUIT-CONTROLLER FOR ELECTRIC MOTORS. Warren S. Hill, Hyde Park, Mass.
494,786. AUTOMATIC CUT-OUT FOR SIGNALING BOXES. Jacob F. Mehren, Chicago, Ill.
494,787. AUTOMATIC CUT-OUT FOR ELECTRIC SIGNALING MECHANISMS. Jacob F. Mehren, Chicago, Ill.
494,828. ELECTRICAL MEASURING-INSTRUMENT. Edward Weston, Newark, N. J.
494,829. RECORDING-VOLTMETER. Edward Weston, Newark, N. J.
494,830. GROUND-DETECTOR FOR ELECTRIC CIRCUIT. Edward Weston, Newark, N. J.
494,832. ELECTRIC CLOCK. Herman Wubbeler, Beaver Falls, Pa.
494,836. DYNAMO-ELECTRIC MACHINE. Arthur S. Baxendale, Selangor, England.
494,849. SEPARATOR FOR BATTERY ELEMENTS. Chaimsonovitz P. Elieson, New York, N. Y.
494,852. GALVANIC BATTERY. Derrick H. Fitch, Casenovia, N. Y.
494,856. ELECTRIC GENERATOR OR MOTOR. Walter T. Goolden and Llewelyn B. Atkinson, London, England.
494,961. ELECTRICAL MEASURING-INSTRUMENT. Adolf Korpoel, Berlin, Germany.
494,964. GALVANOMETER. Edwin F. Northrup, Ardmore, Pa.
494,966. CIRCUIT-CLOSING CLOCK. Herbert S. Page, Medford, Mass.
494,987. ELECTRIC MOTOR. Francis B. Crocker and Schuyler S. Miller, New York, N. Y.